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PROCEEDINGS OF THE THIRD ANNUAL CONVENTION

OF THE

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS

HELD AT
CHICAGO, ILLINOIS,

* * *

October 14th, 15th and 16th,
1896,

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AMERICAN SOCIETY
MUNICIPAL IMPROVEMENTS

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American Society of Municipal Improvements.

OFFICERS

1894-1895.

President	M. J. MURPHY	St. Louis, Mo.
First Vice President	G. H. BENZENBERG	Milwaukee, Wis.
Second Vice President	GEO. S. GATCHELL	Buffalo, N. Y.
Secretary	D. L. FULTON	Allegheny, Pa.
Treasurer	A. JORALEMAN	Newark, N. J.

1895-1896.

President	G. H. BENZENBERG	Milwaukee, Wis,
First Vice President	AUGUST HERRMANN	Cincinnati, O.
Second Vice President	WILLIAM D. KERR	Chicago, Ill.
Third Vice President	JAMES E. McGANN	New Haven, Conn.
Secretary	D. L. FULTON	Allegheny, Pa.
Treasurer	JOHN L. KENNEDY	Nashville, Tenn.

[illegible]E COMMITTEE.

L. W. RUNDLETT	St. Paul, Minn.
F. G. O'BRIEN	Oswego, N. Y.
W. N. GLORE	Covington, Ky.

1896-1897.

President	AUGUST HERRMANN	Cincinnati, O.
First Vice President	E. B. GUTHRIE	Buffalo, N. Y.
Second Vice President	WILLIAM D. KERR	Chicago, Ill.
Third Vice President	ERNEST ADAM	Newark, N. J.
Secretary	D. L. FULTON	Allegheny, Pa.
Treasurer	JOHN L. KENNEDY	Nashville, Tenn.

FINANCE COMMITTEE.

L. W. RUNDLETT	St. Paul, Minn.
G. H. MONRO	Omaha, Neb.
F. J. O'BRIEN	Oswego, N. Y.

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Standing Committees.

Appointed by President in accordance with Article IV, Section 4, of the Constitution of the Society.

1895-1896.

STREET PAVING.

A. D. THOMPSON, Peoria, Ill.
NELSON P. LEWIS, Brooklyn, N. Y.
W. G. WILKINS, Allegheny, Pa.

ELECTRIC STREET LIGHTING.

J. A. CABOT, Cincinnati, O.
F. W. CAPPELEN, Minneapolis, Minn.
J. H. PEARSON, Louisville, Ky.

SEWERAGE AND SANITATION.

GEORGE H. FROST, Plainfield, N. J.
M A. DOWNING, Indianapolis, Ind.
PETER WEIDNER, Dayton, Ohio.

WATER WORKS AND WATER SUPPLY.

E. H. KEATING, Toronto, Ontario.
M. L. HOLMAN, St. Louis, Mo.
H. R. SHERRERD, Newark, N. J.

TAXATION AND ASSESSMENT.

G. F. MONRO, Omaha, Neb.
S. C. HATHAWAY, New Bedford, Mass.
R. E. HORNER, Parkersburg, W. Va.

CITY GOVERNMENT AND LEGISLATION.

CHARLES CARROL BROWN, Omaha, Neb.
C. C. WADDEL, Chillicothe, O.
L. E. FARNHAM, Camden, N. J.

DISPOSITION OF GARBAGE AND STREET CLEANING.

DR. J. L. HESS, Cleveland, O.
FRANK V. MATTY, Syracuse, N. Y.
S. BROCKMAN, Milwaukee, Wis.

REVIEW.

LANSING W. BEACH, Washington, D. C.
M. DRAKE, Buffalo, N. Y.
E. W. BOYNTON, Davenport, Ia.

Special Committees.

Appointed by President in accordance with resolutions adopted by the Society.

COATING OF CAST IRON AND STEEL RIVETED PIPES.

GEO. H. BENZENBERG, Milwaukee, Wis.
M. R. SHERRERD, Newark, N. J.
L. W. RUNDLETT, St. Paul, Minn.

ELECTROLYSIS.

F. W. CAPPELEN, Minneapolis, Minn.
HAROLD P. BROWN, New York, N. Y.
C. S. BROWN, Toledo, O.

ABOLISHING OF RAILROAD CROSSINGS IN CITIES.

H. J. STANLEY, Cincinnati, O.
L. B. JACKSON, Chicago, Ill.
ROBT. E. McMATH, St. Louis, Mo.

AMERICAN SOCIETY
OF
MUNICIPAL IMPROVEMENTS.

CONSTITUTION OF THE SOCIETY.

ARTICLE I.—NAME AND OBJECT.

Sec. 1. The objects of this society, which shall be known as "The American Society of Municipal Improvements," shall be to disseminate information and experience upon, and to promote the best methods to be employed in, the management of municipal departments and in the construction of municipal works, by means of annual conventions, the reading and discussion of papers upon municipal improvements, and by social and friendly intercourse at such conventions, and to circulate among its members, by means of an annual publication, the information thus obtained.

ARTICLE II.—MEMBERSHIP.

Sec. 1. Any municipality within America shall be eligible to membership in this society; likewise any engineer, officer, or director who shall have charge of or supervision over, or be employed as a consulting engineer on, any public or municipal department work. When a municipality has become a member of the society, then any person of such municipality representing any municipal board or department may also become a member.

Sec. 2. Every application for membership shall be in writing, stating the name, location, and department; and, if of an individual, shall also state the age, residence, and position of the applicant.

Sec. 3. Any member who shall have ceased to have charge or supervision of any public or municipal department or work may become an associate member, who shall enjoy all the rights and privileges of full membership, excepting that of holding office or voting.

Sec. 4. Any member who shall be in arrears for more than one year's dues shall be considered as no longer a member of this society, and his or its name shall be discontinued from the roll by the Secretary.

Sec. 5. Any member may withdraw from the society upon payment of all dues to date, and by notifying the Secretary thereof in writing.

Sec. 6. Any member may be expelled from the society upon the recommendation of the Executive Committee, adopted by a two-third vote of all the members present.

ARTICLE III.—Fees and Dues.

Sec. 1. Each municipality desiring to become a member of this society may do so by the payment of five dollars admission fee, which will entitle said municipality to as many members to said society representing boards or departments of said municipality as may be desired without any additional admission fee, but upon payment of the dues hereinafter prescribed.

Sec. 2. Municipalities shall not be required to pay any dues; but each individual representing any department of a municipality that has acquired a membership in the society, or any associate member, shall pay three dollars per annum as dues, the same to be payable on or before the date of the annual meeting.

ARTICLE IV.—Officers.

Sec. 1. The officers of this society shall consist of a President, three Vice-presidents, a Secretary, and a Treasurer, each of whom shall be a resident of a different state, and who with the past presidents shall act as an Executive Committee for and in behalf of the society.

Sec. 2. There shall also be elected a Finance Committee, consisting of three members of the society.

Sec. 3. In case of any of the above positions, excepting the presidency, becoming vacant, or in case of their absence during the annual convention, the President shall fill such vacancy by appointment from the membership.

Sec. 4. There shall be appointed annually the following Standing Committees:

1. Street-Paving;
2. Electric Street-Lighting;
3. Sewerage and Sanitation;
4. Waterworks and Water-Supply;
5. Taxation and Assessments;
6. City Government and Legislation;
7. Disposition of Garbage and Street Cleaning.

The number on each committee shall be three, and the chairman may add such names as he may deem advisable.

ARTICLE V.—Election.

Sec. 1. The officers of this society shall be elected by ballot on the second day of each annual convention, and each municipality shall be entitled to as many votes as it has representatives present.

Sec. 2. The President shall not be eligible for immediate re-election (except by a unanimous vote).

Sec. 3. The officers elected shall assume office immediately after the close of the annual meeting at which they were elected.

Sec. 4. The ballot for any officer may be waived by unanimous consent.

ARTICLE VI.—Duties.

Sec. 1. The President shall preside at the meetings of the society and at those of the Executive Committee, and shall perform such other duties as are incumbent upon the office. In the absence of the President, or upon his becoming ineligible, the senior Vice-president shall assume and perform the duties of the office.

Sec. 2. The Secretary shall keep accurate minutes of the proceedings of the society and of the Executive Committee; shall conduct all correspondence; shall issue notices of any meeting of the society not less than four weeks prior to the date of such meeting; shall collect and receipt for all fees and dues, and pay them to the Treasurer quarterly, taking his receipt for the same; and keep accurate account between the society and its members.

Sec. 3. The Treasurer shall receive from the Secretary and safely keep all moneys belonging to the society, giving his receipt therefor; shall pay all bills approved by the Finance Committee or the President; shall keep a correct account of the funds of the society, and submit to it at its annual meeting a report of all receipts and disbursements during the preceding year.

Sec. 4. The Executive Committee shall manage all the affairs of the society, subject to the action and approval of the society at its meeting. All questions in Executive Committee shall be decided by a majority vote, and five members shall constitute a quorum, not less than four of whom shall be officers of the society. The Executive Committee shall meet at least once each year, on the morning of the first day of the annual meeting of the society, and as much oftener as the President may determine.

Sec. 5. The Finance Committee shall meet on the morning of the first day, and previous to the annual meeting of the society, to examine and audit the Secretary's and Treasurer's accounts and annual statements, and report thereon to the society.

Sec. 6. It shall be the duty of the chairman of each standing committee to prepare a report, with the aid of his fellow-committeemen, and submit the same at the annual meeting.

Sec. 7. One afternoon and such other time as may be deemed necessary shall be devoted to sectional work, the chairman of each standing committee acting as chairman of the section. The chairman of each section shall arrange the programme of the sectional meetings in connection with the programme committee of the society.

ARTICLE VII.—Meetings.

Sec. 1. The annual meeting of this society shall be held on the second Wednesday in October of each year, in such city as the majority of the members voting shall decide. Selection of place of meeting to be made after the officers shall have been elected.

Sec. 2. At any annual meeting of the society fifty members shall constitute a quorum for the transaction of business.

Sec. 3. Any member with the concurrence of the presiding officer may admit friends to the meeting of the society, but such person or persons shall not without the consent of the meeting be permitted to take part in any discussion.

Sec. 4. All papers, drawings, etc., submitted to the meeting of the society shall be and remain the property of the society.

ARTICLE VIII.—Order of Business.

Sec. 1. At the annual meeting of the society the order of business shall be as follows:

1. Roll call;
2. Reading of minutes of last meeting;
3. Considering of applications for membership;
4. The President's address;
5. Reports of the Secretary and the Treasurer;
6. Report of the Executive Committee;
7. Report of the Finance Committee;
8. Reports of special committees;
9. Reading and discussion of papers;
10. Election of officers;
11. Selecting next place of meeting;
12. General business.

Sec. 2. All questions shall be decided by vote, and all differences of opinion in regard to points of order shall be settled by parliamentary practice, as set forth in Cushing's Manual.

ARTICLE IX.—Amendments.

Sec. 1. The foregoing constitution and articles may be amended on or after the second day of any annual meeting of the society by a two-third vote of all members voting; provided such proposed amendment shall have been submitted to the society in writing on the first day of its annual meeting.

American Society of Municipal Improvements.

* * *

MEMBERS.

1896-1897.

Atchison, Kan	Fred. Giddings	City Engineer.
Allegheny, Pa	W. G. Wilkins	" "
"	D. L. Fulton	Superintendent of Highways.
Akron, O.	S. W. Parshall	City Engineer.
Bloomington, Ill	W. P. Butler	" "
Binghampton, N. Y.	S. E. Monroe	" "
Buffalo, N. Y	Edw. B. Guthrie	Chief Engineer.
"	Thos. F. Maloney	Superintendent Streets.
"	M. M. Drake	Board of Public Works.
Brooklyn, N. Y	N. P. Lewis	Eng. Street Construction.
Bridgeport, Conn	F. E. Clark	Mayor.
"	Benj. Miller	Mayor's Clerk.
"	F. W. Beers.	Pres. Board of Public Works.
Burlington, Ia	William Steyh	City Engineer.
Camden, N. J	W. H. Tice	Department Streets.
"	H. J. Sharp	" "
"	E. S. Mills	" "
"	L. E. Farnham	City Engineer.
"	Chas. P. Sayrs	Chairman Public Works.
"	John Blowe.	Street Commissioner.
Concord, N. H	W B. Howe	City Engineer.
Champaign, Ill	Arthur N. Talbot	Consulting Engineer.
Chillicothe, O	C. C. Waddle	Mayor.
"	H. M. Redd	City Engineer.
"	W. W. Fair	Department Public Works.
"	Geo. E. Mosher	" "
"	Chas. H. Rentinger	" "
"	George L. Emmel	" "
"	S. Earl Mosher	Ex-Councilman.
Cincinnati, O.	Aug. Herrmann	Pres. Board Administration.
"	John Frey	Board Administration.
"	John B. Washburn	" "
"	Geo. T. Sterritt	" "
"	J. W. Prendergast, M. D.	Health Officer.
"	Geo. A. Vandegrift	Board of Administration.

Cincinnati, O.	Ed. Bogen	Superintendent Infirmary.
"	A. P. Butterfield	Clerk Board Administration.
"	H. J. Stanley	Chief Engineer.
"	Willis P. Tharp	Supt. & Eng. Water Works.
"	Fred. Amthauer	Supt. Street Cleaning.
"	J. A. Cabot	City Electrician.
"	R. H. Warder	Superintendent Parks.
"	Albert Cox	Purchasing Agent.
Chicago, Ill	L. B. Jackson	City Engineer.
"	H. D. Patton	City Sealer.
"	W. D. Kent	Commissioner Public Works.
"	G. L. Clausen	Supt. Bureau Sewers.
"	W. R. Kerr	Health Commissioner.
Covington, Ky	J. L. Rhinock	Mayor.
"	D. Seeger	Water Works Commissioner.
"	W. H. Glore	Superintendent Water Works
"	Thos. H. Kennedy	City Engineer.
Cleveland, O.	J. L. Hess, M. D	Health Officer.
"	D. E. Wright	Director of Public Works.
Concord, N. H	W. B. Howe	City Engineer.
Dayton, O.	C. A. Herbig	City Comptroller.
"	Wm. F. Miller	Assistant City Comptroller.
"	Peter Weidner	Pres Board City Affairs.
"	O. E. Davidson	" "
"	T J. Backus	Superintendent Streets.
"	F. M. Turner	City Engineer.
"	Chas. E. Rowe	Secretary Water Works.
"	B. B. Childs	Trustee Water Works.
"	R. T. McGregor	" "
Davenport, Ia	E. W. Boynton	Commissioner Public Works.
Dubuque, Ia.	W. H. Knowlton	City Engineer.
"	H. B. Gniffke	City Treasurer.
"	John E. Stemm	City Assessor.
Eau Claire, Wis	C. A. Alderman	City Engineer.
Fort Wayne, Ind	Peter Eggemann	Board Public Works.
"	A. M. Schmidt	" "
"	P. H. Kane	" "
"	Chas. Herwig	" "
"	B. Barkenstein	Councilman.
Grand Rapids, Mich	F. Letellier	Board of Public Works.
" " "	J. J. McVean	" " "
" " "	L. C. Stowe	" " "
" " "	H. A. Collar	City Engineer.

Hamilton, O.	L. A. Dillon	City Engineer.
Harrisburgh, Pa.	John McConkey	Highway Commissioner.
Indianapolis, Ind.	M. A. Downing	Ch'n. Board Public Works.
"	B. J. T. Jeup	City Engineer.
Kalamazoo, Mich.	J. R. McCall	Street Commissioner.
Lafayette, Ind.	Wm. K. Eldridge	City Engineer.
Los Angeles, Cal.	C. S. Compton	City Engineer.
Lima, O.	R. H. Gamble	City Engineer.
Louisville, Ky.	J. H. Pearson	"
Mansfield, O.	H. A. Sloan	President of Council.
Milwaukee, Wis.	Geo. H. Benzenberg	City Engineer and President Board Public Works.
"	S. J. Brockman	Department Public Works.
"	Fred. Schneider	" "
"	Paul Meunzberg	" "
Marietta, O.	Jacob Rech	Councilman.
"	Phillip Bachmann	"
"	B. F. Wood	"
"	S. J. Hathaway	President Council.
Minneapolis, Minn.	F. W. Cappelen	City Engineer.
Newark, N. J.	Wm. Stainsby	Pres. Board Public Works.
"	Harrison Van Duyne	Board Public Works.
"	Abram Joraleman	Board Public Works.
"	Wm. Greathead	Clerk Board Public Works.
"	Peter Ulrich	Board Public Works.
"	John Burkhardt	" "
"	M. R. Sherrerd	Engineer Water Department.
"	Ernest Adam	City Engineer.
Nashville, Tenn.	John L. Kennedy	Board Public Works.
New Bedford, Mass.	A. L. Blackmer	" "
"	S. C. Hathaway	" "
"	Chas. O. Brightman	" "
"	Wm. S. Cook	Clerk Board Public Works.
New Haven, Conn.	L. H. Johnson	Pres. Board of Public Works.
Newport, Ky.	John Surran	Supt. Water Works.
"	W. L. Glazier	City Engineer.
"	Jas. Knoblock	Supt Public Works.
New York, N. Y.	Harold C. Brown	Consulting Engineer.
Nashua, N. H.	Fred. F. Stark	Pres. Pennichuk Wr. Works.
Omaha, Neb.	Charles Carrol Brown	Consulting Engineer.
"	Geo. F. Munro	President Public Works.
"	Frank J. Kaspar	Member Public Works.
Oswego, N. Y.	F. J. O'Brien	Supt. Public Works.

Parkersburg, W. Va.	R. H. Thomas	Mayor.
"	R. E. Horner	
"	W. W. Van Winkle	
"	W. H. Chancellor	
"	H. H. Moss	
Peoria, Ill	Will O. Clark	Commissioner Public Works.
"	Jacob A. Harman	Ex-City Engineer.
"	A. D. Thompson	City Engineer.
Plainfield, N. J	Geo. H. Frost	Chairman Sewer Committee.
Portland, Me.	Geo. N. Fernald	City Eugineer.
Quincy, Ill	D. F. Dederick	
Richmond, Conn	Jos. J. Ratliff	Secretary Park Com.
Saginaw, Mich	R. W. Roberts	Ex-City Engineer.
South Bend, Ind	W. M. Whitten	City Engineer.
St. Louis, Mo	Robert E. McMath	Pres. Public Improvements.
"	M. L. Holman	Water Commissioner.
"	B. H. Colby	Sewer Commissioner.
"	Frank L. Ridgeley	Park Commissioner.
"	C. H. Stone	Harbor and Wharf Com'r.
"	A. N. Milner	Street Commissioner.
Syracuse, N. Y	Russel R. Stuart	City Engineer.
"	Robert Ballard	Member Board of Aldermen.
"	Frank V. Matty	Pres. Board of Aldermen.
"	Duncan W. Peck	
"	Henry L. Allen	Ex-City Engineer.
St. Paul, Minn	L. W. Rundlett	City Engineer.
"	John Copeland	Commissioner Public Works.
Sheboygan, Wis.	C. N. Boley	City Engineer.
Toledo, O	C. S. Brown	Water Works Trustee.
Toronto, Can.	E. H. Keating	City Engineer.
"	John Jones	Street Commissioner.
"	Bernard Saunders	Chairman Board of Works.
"	John K. Leslie	Chairman Exhibition Com.
Williamsport, Pa	Geo. D. Snyder	City Engineer.
Washington, D. C	Lansing H. Beach	Captain Engineers.
"	Wm. C. Woodward, M. D.	Health Officer.
Washington, C. H., O.	H. B. Brownell	Councilman.
Youngstown, O	F. M. Lillie	City Engineer.
"	Rudolph Kurz	Councilman.
"	Veeder Heasley	Pres. Board City Comrs.
"	John DeVenne	President Councils.
Zanesville, O	I. P. Farquhar, M. D.	Councilman.

AMERICAN SOCIETY

OF

MUNICIPAL IMPROVEMENTS.

THIRD ANNUAL CONVENTION,

Chicago, Ill., Oct. 14, 15, and 16, 1896.

WEDNESDAY, OCTOBER 14, 1896—MORNING.

The meeting was called to order at 10:30 o'clock on the morning of October 14th, at Kinsley's Hall, the President, G. H. Benzenberg, in the chair.

THE PRESIDENT: Gentlemen, before proceeding with the business of the convention I wish to apologize for the lateness of the opening of this convention. Most of the members have come in this morning quite late, they were anxious to register at the headquarters at the Great Northern, and we had to suspend that order of business in order to not further delay the opening of this convention. That is the reason that we have not been prompt on the start. Hereafter we will try to be prompt if you are.

Gentlemen, I have the pleasure of introducing to you his Honor, the Mayor of Chicago, who wishes to extend the welcome of this city and its administration to you as members of this convention.

MAYOR SWIFT, Chicago, Ill.: Mr. Chairman and Gentlemen: I noticed in the morning papers that the Mayor of Chicago was to deliver an address at the opening of your convention. That sounds rather formal. I am here simply to welcome you as representatives of the representative cities of this country to the hospitality of our city. I trust that your deliberations will be of benefit, not only to yourselves, but our city. The citizens of Chicago have placed in the hands of a local committee, the Chairman of which is our well-known citizen, Gen. FitzSimons, the charge of looking after your entertainment, and I assure you you will be well cared for.

The questions you will deliberate upon are of very great importance to us and we will watch with interest what you have to say, and study with greater interest the papers that will be read before this convention. Chicago, as you know, is but a young city comparatively, and while we are undertaking great works and expending large sums of money in carrying out these works, we expect to learn much from those who have wider experience, and so I say, we will look forward with a great deal of interest to the papers to be read before your convention. I assure you, gentlemen, that the citizens of Chicago extend to you a hearty welcome with the expectation that you will have a royal good time socially and intellectually. [Applause.]

The President: Your Honor, with a full appreciation of the sentiments and words you uttered we gratefully accept your tender of hospitality and of welcome to your great city, the Metropolis of the West at least, if not ere long of the country. We have come here not so much for the purpose of being entertained at the hands of your citizens and your administration, as to exchange our experiences and our knowledge upon the various matters of interest to the constitutents we represent in our official capacity, and I hope that before the close of this convention it may be recognized, not only by yourself, but by your citizens, that it has been a benefit to Chicago that this convention has been held here, that we have deliberated upon some subjects, have left some information which will not only be of benefit to ourselves, but possibly a service to your city, and in that way to some extent return the kindness and courtesy you have extended to us. We thank you kindly for the welcome extended.

Gentlemen, we have with us the Chairman of the Committee of Arrangements, Gen. FitzSimons, who, I believe, has some announcements to make at this time.

GEN. FITZSIMONS: Mr. Chairman and Members of the Society: The arrangements which have been alluded to by the Mayor, I am glad to say, are in the hands of an efficient committee, who has arranged on Friday evening to tender to the members of this association a banquet, for the interchange of sentiment, and it is hoped a pleasant hour will be spent. On Saturday morning we have made provision for a trip on the lake, to visit the water works and cribs, which are at present a subject of considerable anxiety to us. Nevertheless, we can show you plenty of water, and, with the assistance of our Commissioner of Health, we may possibly be able to have something there to dilute it, if it is found too bad.

As Chairman of the Committee of Arrangements I have to apologize for knowing so little about your society. I have not been a member of it at any previous meeting, and I am entirely unable to say anything at the present time further than that we will do the best we can to entertain you and make it pleasant for you and profitable for us. It is rumored that the Drainage Commissioners will offer this association an opportunity of visiting the main drainage canal on Thursday. Due notice will be given of the hour at which trains will leave. This work is of great importance and the Committee hopes to see every member of the society on that occasion.

THE PRESIDENT: Gentlemen, as the hour is late we will immediately proceed with the business of the convention. The order of business is roll-call, unless some one moves a suspension of it at this time, there being undoubtedly the necessary number of members present to establish a quorum. I will entertain a motion that the roll-call and the reading of the minutes be dispensed with.

A motion that the roll-call and reading of minutes be dispensed with was unanimously carried.

THE PRESIDENT: The next matter is the consideration of applications for membership.

THE SECRETARY: I have not had any applications. I have had a number of inquiries from different parties, but I have not had any formal applications for membership.

THE PRESIDENT: A number of applications have been made to me and undoubtedly to the Secretary, and others will come in continually during the convention, therefore the matter will be referred to the Secretary, unless there is an objection. Hearing no objection, Mr. Secretary, it is so ordered.

At this time I would like to request each member who arises to address the chair, to give his name and the city he represents, so that the reporter may get the names and the residence of the parties.

MR. STAINSBY, Newark, N. J.: I ask the question in behalf of a number of representatives of cities who, like myself, would like to know how to become a member of this association?

THE PRESIDENT: Under the constitution, any city who pays the admission fee becomes a member of this association. That membership of the city entitles any of its officials to become a member without the payment of the membership fee, but, upon the payment of the annual dues of $3.00. If the membership is taken out in the name of the individual, the conditions are the same—he pays the admission fee of $5.00 and the annual dues of $3.00 thereafter. However, if it is taken out in the name of the city, no further admission fee is required from the representatives of the city, but merely the payment of the $3.00 annual dues, which is necessary to cover the expenses of printing and taking down the proceedings of the convention and other expenses necessary to the running of the association.

Gentlemen, according to the by-laws it is incumbent upon the President to submit an annual report or address to the convention. In compliance with that order, I will now submit my address.

PRESIDENT BENZENBERG'S ADDRESS.

GENTLEMEN:

The sincere and hearty welcome extended to the members of this society certainly makes it doubly pleasant to us as the representatives of the various municipalities of this great country and continent to meet again, as an organization whose great object is not so much "better government" as it is to secure to the citizens and taxpayers of these municipalities the most economic and best class of improvements obtainable.

That this object is one worthy of the best efforts and the most earnest study of the men who have been and are intrusted with the projecting as well as with the construction, supervision and maintenance of municipal improvements, must be admitted, especially when you consider the vast sums of money annually expended by these municipalities in the betterment and maintenance of the various kinds of improvements so necessary to the health, comfort and prosperity of the community and that the accumulated properties and improvements of these municipalities represent a value exceeding in amount that of the national debt.

Millions of dollars are annually expended in reconstruction made too frequently necessary by the introduction of improper material, imperfect plans or by the lack of information and experience of those into whose hands such work has been intrusted.

It is not to be supposed that the conditions largely responsible for such state of affairs are likely to be remedied, excepting through the slow process of development towards a more stringent and accountable administration of public affairs. With such evolution, however, this society has no connection, its object being distinctly to improve our competency and efficiency in the discharge of our respective duties by the interchange of experiences, by the presentation and discussion of papers and by preserving in our proceedings for mutual reference and study, such practical information as may be collected.

That there is need for better information is evident from the fact that there is not a city where its citizens are not debating and seeking knowledge upon the question of either street pavements, street lighting, water supplies, sanitation, garbage disposal, municipal control of public utilities, street cleaning, sewage disposal, track construction or a dozen of other subjects which arise with the growth and development of cities. How can we get at the experiences and best practice of other cities on these subjects any better than through the medium of this organization with its annual gatherings and opportunities of personal acquaintanceship? Therefore, with the earnest, sincere and hearty co-operation of all its members united to that end, this society in time cannot but establish a record of acknowledged utility and benefit to the public unsurpassed by any other organization.

Although meeting to-day for the third time, this society was not fully organized until at its last meeting in Cincinnati, nor were its objects fully set forth nor its work intrusted into the hands of committees until at that meeting, hence no organized work of the convention was possible until now.

The faithful and arduous work of the committees, represented in their reports at this meeting, indicates what may be accomplished by systematic and careful investigation, and the members and subjects of the papers to be presented demonstrate clearly the interest of our membership in the questions most prominent in municipal improvements to-day. This work, however, should be expanded, taking in every kind of municipal work, interesting every department of municipal government in all its legislative and administrative branches, uniting them all into one organization whose work could be divided into sections under each department head, considering all topics not only in the entirety but in all its details, for it is the latter which most frequently puzzle the inexperienced in our smaller cities where growth demands new improvements. The best methods of selecting paving brick, of testing sewer pipes, paving and other cements, the most satisfactory and economical system of cleaning streets, of collecting garbage and ashes, of cleaning or flushing sewers, the best manner of regulating the too promiscuous opening of street pavements by corporations and individual property owners, of introducing protective sanitary measures in all house plumbing and draining, of securing the best railway track construction in streets, the abatement of smoke and other nuisances, the regulating of traffic by a wagon or tire tax, of providing the best kind of underground service for all classes of wires, of securing to the public a suitable return for all corporate franchises, of enforcing honest competition and honest work on the part of contractors for public works, are some of the questions in which all are interested and many of us seek the experiences of other cities.

For this purpose have we met to-day and the earnest consideration and close attention to the work of the convention will ensure to every member much desired information and a full appreciation of the benefits each has derived, especially if each one will freely enter into the discussion of every paper or report. Whatever little information any one may have upon any subject, if it be reliable let it be given for the benefit of all and let no one hesitate to ask any question upon any point; there will be some who will answer and give the desired information.

The rapid development and growth of many cities makes necessary that municipal improvements assume a more permanent and durable character, obviating the necessity of frequent reconstruction.

Temporary expedients in municipal work are too frequently expensive mistakes and should be always discouraged.

It is preferable that progress in improvements be slow so they assume a permanent character and relieve the property-owner as much as possible from the burden of reconstruction. Such practice, of course, is not always in the first instance approved of by the taxpayer, but there is no lack of object lessons to demonstrate its economy. Our efforts as an organization should be exerted in that direction and its work will be more readily appreciated by the citizens when they observe that perfection, durability and economy are the motives which direct our convention labors. Much study and committee work will be required to sift out the best methods and results from the different local experiences.

To facilitate such work, I would suggest that a copy of the charter and the ordinances of each city and a copy of the specifications of each class or kind of municipal work and form of contract be sent to the Secretary to be by him arranged under each head and held as the property of the society for reference and use by its committees and members. By the individual effort of each member a valuable collection of documents for reference can thus be easily secured and enable committees without extensive correspondence to obtain desired information. I would also suggest that copies of all annual reports be sent to the Secretary for similar purposes and that he be directed in the name of the society to kindly request such cities on this continent as are not members hereof, to send the annual reports of their various departments to this society for reference, and that, as said reports and papers accumulate, he be authorized to secure a suitable room for the purpose of filing and preserving the same.

I would further suggest that a committee on review be added to the standing committees, said committee to carefully review all annual reports and submit to this society at its annual meeting a synopsis from such reports as contain any data or information of value upon, or an account of any work in which this society or any of its members are interested, giving special attention as to results obtained (be they either favorable or otherwise), and the comparative cost of such work. When a report refers to any new feature or a novel method or design in municipal work particular mention should be made, and, if of enough importance, the official making such report, should be requested to prepare a paper upon the subject, to be read before this society at its next convention. Thus the members can be kept in touch with every new feature or development in public work and with its effect or benefit as to its enhancement and durability.

Much other data could also be collected and tabulated by other committees giving valuable information to our members.

The work of this convention has been arranged so as to group papers pertaining to one general subject and have them follow the report of the committee having charge of that subject. This was done to save time in discussing papers, and, in case it was found necessary, to permit of dividing the work into sections, which could take up different reports and subjects simultaneously.

As all papers following any one committee report are to be read previous to any discussion thereon, the members are kindly urged to make note during the reading of such papers of any point they wish to bring up in discussion, referring to the paper by title.

Very little time during the three days has been allowed for entertainment, perhaps just enough to prevent the work from becoming tiresome, the closing session being set for the fourth day, after the work has been completed, and I hope the arrangements will prove satisfactory to all.

The printing of the proceedings of the last convention and of the first meeting at Buffalo having been intrusted to the Executive Committee, it was placed in the hands of Mr. August Herrmann, the first Vice-president, who, after having, with the approval of the Executive Committee, closed a contract for the printing and binding of the proceedings in book form, gave the work his personal attention and the benefit of his well-known energy. It is no small task to one unaccustomed to it, to get all the papers and corrected copies of discussion in correct and presentable form, but he certainly succeeded in a comparatively short time. The value of the report of the convention work is in inverse ratio to the time it takes to get them into the hands of our members and hence no time must be lost in publishing the proceedings.

In all the work preparatory to publishing the proceedings, in distributing the same and in the work of his office and that incidental to this convention, I have found our Secretary, Mr. D. L. Fulton, especially well qualified, prompf and painstaking.

Some considerable time was wasted in getting out a suitable "Certificate of Membership," because of the general desire of having a lithographed certificate, if it could be obtained at a reasonable price and within the means of the society. Such certificate of approved design I finally ordered to be lithographed and the same will be ready for distribution at this meeting. It is hoped that the work and design will meet with the general approval of the members.

It is perhaps unfortunate that one year ago it did not occur to any one that the date then agreed upon for this meeting would be but a few weeks previous to the holding of a national election and in the midst of an animated canvass, or most likely the time for this convention would have been changed. The interest in this election has prevented very many from attending this meeting who under all other conditions would have been present, and it is undoubtedly the cause for the very limited attendance to-day. This, however, will not interfere with our interest in the work nor our enjoyment of greeting old friends and meeting new ones.

If we are to do the good work which we have set out to do, we must apply ourselves to the task with earnestness and patient consideration, and demonstrate upon our return that by this interchange of experience and information through argument and discussion we *have* learned something that will contribute to the benefit of the municipalities we represent.

THE PRESIDENT: Gentlemen, the next business in order is the report of the Secretary and Treasurer. The Secretary informs me that he has left his records and papers at the hotel in his haste to proceed over here, so that the reading of his report will be deferred until later in the day.

A MEMBER: The Treasurer has submitted his account to the Finance Committee. They are now preparing their report and it will be ready in a short while, I suppose.

THE PRESIDENT: Then we will defer the report of the Treasurer until the report of the Committee on Finance is submitted.

Gentlemen, I see a number of you have not been provided with badges and as undoubtedly many of you have not yet registered or handed in your certificates and as it is necessary, in order to secure the benefit of the one and one-third fare, granted to us by the Western, Central and Trunk associations, that these certificates be in the hands of the Secretary at as early a moment as possible, I will declare an intermission of fifteen minutes unless some one has a matter of business to bring up at this time.

An intermission was here taken, at the end of which intermission the report of the Committee on Finance was read by Mr. L. W. Rundlett, as follows:

REPORT OF FINANCE COMMITTEE.

AMERICAN SOCIETY MUNICIPAL IMPROVEMENTS:

Your Finance Committee herewith submits the following report: We have carefully examined the books of the Treasurer of the society; have checked up his receipts and disbursements, and find his financial statement correct.

All vouchers of expenditure have been authorized and approved by the proper committee, and we desire to express our appreciation of the careful manner in which the accounts have been kept.

We submit herewith the Treasurer's report to the Finance Committee which we would embody with and make a part of our report. From said report we find there is a balance of $192.24 to the credit of the society, but we understand the Secretary's salary for the past year has not been paid; also there are quite a number of outstanding bills that have been incurred by the various committees which have not as yet been presented and approved by the proper authorities.

Therefore, it will be necessary, before we can make an accurate report of the financial condition of the society, or to make any recommendations for the future, that all of these accounts should be presented. We will therefore request that any of the committees or members of the society who have any of these claims would hand them in at once, so that they may be either allowed or rejected, and your committee will then, before the close of the convention, make an additional report and such recommendation as may be seen advisable.

Very respectfully submitted,
L. W. RUNDLETT,
F. J. O'BRIEN,
W. H. GLORE,
Finance Committee.

TREASURER'S REPORT.

To the Honorable, the Finance Committee of the American Society of Municipal Improvements:

The undersigned hereby exhibits an account of receipts and disbursements as Treasurer of the said society from the time of his appointment in September, 1895, to the present time.

Cash Receipts.

1895.		
Sept. 20th..	From D. L. Fulton, Sec'y, as per his letter Sept. 18/95.	$526.00
1896.		
Mar. 12th..	From D. L. Fulton, Sec'y, as per his letter of Mar. 10/96	58.50
	Total receipts	$584.50

Disbursements.

1895.		
Nov. 1st	Paid A. P. Butterfield for cash advanced to pay for printing 500 copies of By-Laws. Account approved by G. H. Benzenberg, Pres., and D. L. Fulton, Sec'y.	$12.00
Nov. 1st	Paid Louis Traub for transcribing 172 pages in triplicate of the proceedings of the second annual convention of this society held in Cincinnati in Sept. 1895. Account approved by G. H. Benzenberg, Pres., and D. L. Fulton, Sec'y	125.00
Dec. 14th	Paid D. L. Fulton, Sec'y, his account for stationery. Account approved by G. H. Benzenberg, Pres	23.85
1896.		
Jan. 7th	Paid Commercial Gazette Job Printing Co. for the annual reports of society, stationery, etc. Account approved by G. H. Benzenberg, Pres., and Aug. Herrmann, V.-Pres.	216.60
Mar. 13th	Paid D. L. Fulton, Sec'y, for printing, postage and postal cards and expressage. Account approved by G. H. Benzenberg, Pres.	14.81

Total disbursements.	$392.26
Cash receipts.	$584.50
Disbursements.	392.26
Cash on hand	$192.24

This amount, one hundred and ninety-two dollars and twenty-four cents, is now to the credit of your Treasurer in the Fourth National Bank of Nashville, Tenn.

The Treasurer submits herewith the accounts as approved and the receipts therefor in accordance with the foregoing statement,—also his pass-book with the said Fourth National Bank, showing the deposits, the checks and the balance of cash on hand.

Respectfully submitted,
JOHN L. KENNEDY,
Treasurer.

This October 14th, 1896.

A motion was made that the report of the Finance Committee be approved and printed with the proceedings.

The President: In connection herewith I desire to call your attention to one fact, that the necessary expenditures of the society, which are, in the first instance, the expense of taking down the minutes and proceedings of the convention, the printing of those proceedings and expenses of the Secretary and his office, will amount to about $500, and our income by dues should at least equal that amount. For that reason it is urged that all those who are here as delegates should become members, and whose cities have a membership in this organization should become members by the payment of the annual dues of $3.00. It is but a small amount and if every delegate and representative coming here will contribute that amount, it may bridge the society over any deficiencies in the necessary expenditure of the organization. Those expenditures have got to be made in order to make the society what we set out to make it. The expenses of the convention and the printing of the proceedings and the running of the Secretary's office are necessary expenses. There are other expenses incidental to the organization, but they may be reduced. The amount that is now in the hands of the Treasurer is not sufficient to pay the amount outstanding against this organization at present. You have heard the motion. All those in favor of it, manifest by saying aye.

Motion for approving and printing report was unanimously adopted.

THE PRESIDENT: Is there any other business before the convention at this time? Gentlemen, a great deal of work has been crowded into the working sessions beginning with 2 o'clock this afternoon, and it is necessary for us all to be here promptly, as it is necessary to start promptly at 2 o'clock in order to get through with the work that is outlined. Therefore, I will kindly request you to be on time this afternoon. If there is no other business the convention will stand adjourned until 2 o'clock this afternoon.

The afternoon session was called to order by President Benzenberg at 2 o'clock P. M.

The report of the Committee on Street Paving was read by the Chairman, A. D. Thompson, of Peoria, Ill., as follows:

REPORT OF COMMITTEE ON STREET PAVING.

To the American Society of Municipal Improvements:

Gentlemen: Your Committee on Street Paving begs leave to submit the following report:

It was the unanimous opinion of the members of this committee that the interests of the society could be best served by procuring papers upon Street Paving from the various members to be presented at this convention. In pursuance of this plan we forwarded to each member of the society on July 17, 1896, a circular letter, calling attention to the next meeting, the importance of street paving, and requesting papers to be forwarded to the committee by Sept. 10th. Subjects for interesting papers were also suggested. The papers were requested to be in the hands of the committee at this early date in order that abstracts might be prepared and forwarded to the members, thus giving them an opportunity to prepare written discussions upon same. This method would have economized the time of the convention, and made the discussions of more value.

The circular letter did not meet with the response that had been expected, only fourteen replies being received, and the plan above mentioned was abandoned. On Aug. 21, 1896, a second circular letter was forwarded to each member of the society, and a large number of personal letters written to various men whom the committee deemed especially competent to prepare papers upon this subject. This circular was more urgent than the first, and received a more generous response. The committee has secured thirteen papers, relating to the subject of street paving, all of which will be presented this afternoon and evening.

It was the desire of the committee to extend this work and procure statistics from the principal cities of the United States and Canada, giving the first cost, cost of repairs, method of construction and durability of the various pavements, but an unusual busy season for all the members has prevented the compilation of this data.

Respectfully submitted,
A. D. THOMPSON,
Chairman.
N. P. LEWIS,
S. J. HATHAWAY,

On motion the report of the committee was approved and ordered printed in the proceedings.

The President: The first paper under the head of Street Pavements is by Mr. N. P. Lewis, Engineer of Street Construction and Maintenance, Brooklyn, N. Y.

Mr. Lewis then read the following paper:

THE NEED OF A LABORATORY FOR THE TESTING OF ASPHALT AND ASPHALT PAVEMENTS.

NELSON P. LEWIS, ENGINEER OF STREET CONSTRUCTION AND MAINTENANCE, BROOKLYN, N. Y.

It must be admitted that the chemical properties of asphaltum and the other materials which are combined form the asphalt pavement usually laid in this country at the present time; what change, if any, these elements undergo when mixed together, and what physical and chemical changes take place in the pavement after subjection to street traffic and exposure to the weather, are subjects which to the municipal engineer are ususally shrouded in mystery. Nor is this surprising. Such pavements are usually laid under a guarantee of from five to fifteen years, and the contractor is very likely to take the ground that he knows from long study and experience just what treatment and mixture will give the best results with his particular material. And if the engineer ventures to insist upon any variation from the methods he wishes to follow why he, the contractor, will not be responsible for the results. He will tell you that Professor ———, the company's consulting chemist, has devoted a lifetime to the study of the subject, and has prescribed a certain mixture and, of course, he knows what will give the best results.

The engineer is thus placed in a difficult position, and is quite likely to accept the contractor's view, while the same is true to a greater degree in the case of the administrative officer at the head of the Public Works Department, who is almost invariably a man without technical training.

The laying of asphalt pavements in American cities has, up to within a very few years, been almost wholly done by one or two companies who obtained their material from a single source, and it was therefore of about the same quality, and, as similar methods were followed, the results were fairly uniform, and, upon the whole, satisfactory.

New sources of supply have recently been developed, and it has frequently happened during the past year or two that, where specifications have been so framed as to admit any materials meeting certain specified requirements, five or six bidders have submitted proposals for laying as many different kinds of asphalt. The municipality should be in a position to profit by this competition. Few, if any, of the new companies are able to refer to pavements which have been laid for five years or more, and, time being the best, and, in many instances, the only testimonial of value, the engineer is in doubt as to whether some of the proposals should be considered. It is generally deemed wise to let others do the experimenting, and, when results have been assured, profit by their experience. The asphalts furnished from different localities differ very materially in chemical and physical characteristics, and each requires special do not seem satisfied as to the best treatment of their material under given conditions of climate and traffic.

The writer's own experience may have been exceptional, but with thirteen contracts carried out by one of the new companies in 1895, he is convinced that not less than six different mixtures were used in laying pavements which would be subject to conditions which were identical.

The engineer is not, and cannot be, expected to be a chemist, though he should have a general knowledge of the properties of asphalt, and should be capable of outlining the investigations to be made, while a young graduate of a good technical school, who has made chemistry the special feature of his course, can carry out the work which may be indicated. The writer is not a chemist, and his intention is not to prescribe the best method, or any method, of conducting a laboratory for the purposes described, but to urge upon the municipal officers forming this convention the necessity of an independent investigation of materials and methods, that they may be able to know exactly what is given them under contracts for asphalt pavements, to correct irregularities and variations in the product, and if results should be unsatisfactory, to indicate the cause and prescribe the remedy. In a word, the engineer should know at least as much about the subject as the contractor.

Judging from the published reports of the engineers of various cities, almost nothing has been done in the line of analysis, or even observation and record of the pavements after they are laid. With one or two notable exceptions, these reports consist merely of a dry recital of the streets which have been paved, the area of the pavement laid, the mileage and total cost. When exceptional efforts are made to be explicit, the character of the work is more fully described, the cost of the different items, and cost per unit of measure are given. There is little, if anything, treatment. Many of the new companies are still feeling their way, and which will add to the general information on the subject, or be of benefit to other municipal engineers.

I do not think that the results which may be obtained from observation and experiment should be regarded as personal capital of the observer or experimenter, but should be added to the general knowledge of the subject, and given to the profession. Without any desire to be personal, I think an outline of the work done in a modest little laboratory recently established by the writer may be of value.

As the result of an earnest request, the Common Council of the City of Brooklyn authorized the equipment of a laboratory for chemical and physical tests of paving material at an expense of $1,000. An unused corner on the top floor of the building in which the Public Works Department is housed, was partitioned off, and the necessary closets, shelving, fume chamber, gas and water pipes were put in. The services of a young graduate of a local technical school, who had for two years after graduation acted as an instructor in quantitative analysis, were secured at a salary of $1,000 a year. An outline of the work to be done was given him, the methods discussed, and apparatus and chemicals essential for the purposes were provided. The cost of fitting up quarters were $385, while that of apparatus and supplies was $650, an excess of $35 over the amount appropriated. A list of the supplies purchased it is unnecessary to give, but the items may be summarized as follows:

Glassware (flasks, beakers, condensers, etc.),	$95
Bottles ("Reagent," "Saltmouth," "Tinctures.")	35
Chemicals	70
Platinum (crucibles, dishes, etc.),	80
Analytical balance.	60
Balance for large weighings	30
Gas stoves, Bunsen burners, ring stands, clamps, etc.	30
Miscellaneous apparatus and accessories	250
Total.	$650

It should be noted that the laboratory was equipped for general analytical work, it being found that the additional cost required to make it complete was trifling when compared with the expense involved in fitting it for asphalt work alone. It was considered poor economy to prepare for asphalt work only and leave ourselves unprepared to make any simple test or determination not strictly in that line.

Early in May we were prepared for work. The scope of the investigations has thus far been modest, and the analyses made are about as follows:

Frequent visits are made to the plants of the different companies and samples of crude and refined asphalt, petroleum residuum, or maltha, with the asphaltic cement, limestone and sand are frequently taken, and partial or complete analyses made. The inspector on the street is always provided with a thermometer to test the temperature of the paving mixture as delivered and laid. Samples of the new pavement are taken from each block, and the location accurately recorded. As many as possible of these samples are analyzed at once, a determination being made of the amount of matter soluble in bi-sulphide of carbon, the percentage of matter volatile at a fixed temperature, and, in a number of cases, in each different kind of material which was laid, the percentage of petroline and asphaltine is determined. Special note is also made of the physical characteristics of the insoluble residue, particularly of the variations in size of the particles. The remainder of the sample is filed away for future reference, the intention being to make examinations of the pavement taken from the same locality at subsequent times and see what changes shall have taken place in the material in the street which has been subjected to traffic of known density, under various degrees of temperature, humidity, etc., and in that which has been lying upon the shelves of the laboratory.

In the asphalts a determination is made of the total bituminous matter, dividing it into petroline and asphaltine, the organic matter, not bitumen, the mineral matter, the specific gravity of the asphalt, etc.

Flash and fire tests are applied to the petroleum residuum oils and their specific gravity is determined, the use of an uniform quality of residuum oil being of great importance. In case a maltha or liquid asphalt is used, as is the practice with the California asphalts, the same tests are applied, while the amount of matter soluble in bi-sulphide of carbon is determined, as well as the percentage of water and matter volatile at 250° F.

The results thus far obtained have been interesting, and have established the reason for several phenomena which were observed, but their greatest value will not be realized until the pavements can be observed after several years of use, while a study of these analyses in connection with data as to the cost of maintenance and of the volume of traffic which the pavement has sustained should add materially to the general knowledge of the subject, and aid in determining the best treatment for the different products.

It is very satisfactory to the engineer to be able to determine the actual cause of any failure or unusual condition which may be observed. Thus when in completing a contract with Alcatraz asphalt the last 100 feet laid appeared suddenly to have lost all its cohesiveness and was not consolidated by the roller, an examination showed that the mixture contained but 4.46 per cent. of matter soluble in bi-sulphide of carbon, while that which had previously been laid showed 8.75 per cent. Of course, the contractor lost no time in removing it, but it showed that there was carelessness somewhere. As there was no change made in the mixture the conclusion was that the tanks were worked too low, and a large amount of mineral sediment was drawn off into the cement. This might have occurred to a much less degree, so as not to have been noticeable and yet resulted in a piece of pavement so low in bitumen as to become friable and disintegrate in a very short time. With a careful and experienced asphalt contractor this would not have happened.

Another case was that of a pavement which in its second summer appeared considerably softer than when first laid, certain spots of limited area being so plastic that a hole could be made entirely through the wearing surface with the heel of one's shoe, while in a few hours it would resume its normal surface. Laboratory examination of the pavement from one of these soft spots showed that in the upper surface the percentage of soluble bituminous matter was 10.74, at the bottom 15.69, while an average sample from top to binder showed 12.91 per cent., and at the bottom next to the binder were found portions of asphaltic cement entirely free from sand. This street was one of the first laid with a binder formed of asphaltic cement instead of coal tar, and the trouble was undoubtedly due to the fact that in spreading the binder course an excess of the cement accumulated at these places which in time soaked up into the wearing surface, forming a mixture too rich in bitumen to sustain ordinary street traffic in hot weather. The same trouble has occurred in pavements laid with tar binder. The necessity is thus shown of carefully removing these portions of the binder where an excess of tar or asphalt appears, and substituting the standard mixture. This will sometimes occur in the work of the most expert contractor, and the inspector should be instructed to insist upon the removal of such patches.

Reference was made above to the sizes of the particles of the minral and other insoluble matter which form about 90 per cent. of the paving mixture. It appears to the writer very important that the sand should be so selected as to show such a graduation of sizes that the voids will be reduced to a minimum. It is well known that the very best asphalt will not resist oxidation if the pavement be porous, and the more perfectly the voids be filled the better will the pavement be able to resist the wear and tear of street traffic.

An examination of a number of paving mixtures showed the following variations in the size of the insoluble residue, the results given being the average of the samples of each kind of pavement which were examined.

PERCENTAGE OF TOTAL INSOLUBLE MATTER RETAINED ON SIEVES OF DIFFERENT MESH.

Kind of Asphalt Used.	10 mesh.	20 mesh.	40 mesh.	60 mesh.	80 mesh.	100 mesh.	Finer than 100.
Trinidad Lake.......	4.60	13.43	27.23	24.42	9.20	1.97	19.15
Trinidad Land.......	0.07	1.11	15.30	53.87	7.42	1.14	21.09
Alcatraz............	0.05	0.74	13.54	38.70	17.61	4.26	25.10
Bermudez...........	0.03	7.34	24.10	31.99	13.42	2.19	20.93

Of course the kind of asphalt used bore no relation to the sizes of the insoluble matter, which were governed by the quality of sand selected for the pavement, and it is given only to identify the contractors using it. It will be seen, however, that the variation is considerable, while there were marked differences in the specimens laid by the same contractor, although the sand used was supposed to be the same. The variations in the percentage of bituminous matter found in the different pavements tested are given below:

PERCENTAGE OF MATTER SOLUBLE IN C.x S.$_2$

Kind of Asphalt Used.	Highest.	Lowest.	Average.	Range.
Trinidad Lake................	9.95	9.31	9.655	0.64
Trinidad Land................	10.36	9.94	10.15	0.42
Alcatraz......................	9.08	8.20	8.673	0.88
Bermudez.....................	9.74	8.48	9.108	1.26

This shows that the contractors using Trinidad Lake and Trinidad Land asphalt were able to control their mixtures somewhat better than the others.

The chief present value of these results is to enable the engineer to discover any tendency to carelessness or irregularity and put him on his guard, while it is expected that they will be extremely useful in subsequent observations of the pavements.

Specimens are being collected from the older pavements where openings are made, and these will be analyzed during the winter and general conclusions can be reached as to the changes which the material has undergone. Too much importance can not be attached to the practice of carefully recording every incident connected with the laying of the pavement, the temperature and other conditions prevailing, the character of the foundation, etc., while rceords should also be preserved of the density and character of the traffic. These should all be compiled in form convenient for reference, and there is little doubt but that in many cases of short-lived and unsatisfactory pavements an intelligent examination of the laboratory and office records will disclose some sin of omission or commission to which the defect can be clearly traced.

The general methods followed in the examination of refined asphalts were those outlined by Miss L. A. Linton in the Journal of the American Chemical Society, Vol. XVI., p. 809.

In the case of pavement mixtures, the samples after having been pulverized in the mortar were weighed out in a suitable flask and disintegrated with successive portions of bi-sulphide of carbon, the solution being each time decanted into a settling jar. This solution, freed from all sediment, is poured into a flask connected with a condenser, the solvent evaporated and the residue weighed.

When time permits this extracted matter is further examined in the same manner as the refined asphalts, especially with a view to the determination of the petroline and asphaltine.

It is not expected to confine our work to the examination of asphalt alone, but analyses are now being made of a number of specimens of vitrified brick—a determination being made of silica, alumina, iron, lime and magnesia, entering into their composition, while the specific gravity and the capacity of absorption are found. Of course all cements used on street paving work are carefully tested in the same laboratory. This work is simply referred to, however, as it is assumed that the physical tests at least of brick and cement are invariably applied. It will be found that the more interesting investigation of the materials and methods used in the laying of asphalt pavements can be made at very slight additional expense.

This brief outline of the work done and the objects sought to be attained is submitted in order to show that a simple laboratory can be established and maintained at a very slight expense, while the results obtained will tend to give the engineer far better control of the work, and enable him to avoid mistakes which will be many times as costly, and at the same time enable the municipality to profit by the competition now existing among the different asphalt companies.

THE PRESIDENT: It is moved that, as there are no further papers on asphalt to be submitted this afternoon, the discussion of this matter be taken up at this time.

The foregoing motion was put to vote and carried.

THE PRESIDENT: Gentlemen, the subject of the paper is before you. Any questions that any of you desire to ask, undoubtedly Mr. Lewis will be glad to answer.

MR. HEASLEY, Youngstown, O.: I would like to ask Mr. Lewis in regard to chemical properties of limestone as applied to asphalt pavements.

MR. LEWIS: This is a subject upon which chemists have not agreed. There are many chemists who maintained for a long time that there was a chemical action on the part of the limestone, but they most of them now believe, I think, that there is none. It is very finely powdered; is as fine in fact as cement is supposed to be, and its principal physical object is to fill the voids of the pavement. I do not think there is any chemical action at all.

MR. SHERRERD, Newark, N. J.: I would like to ask Mr. Lewis, since he has spoken about the chemical properties of asphalt, whether, in their experience, they found that they could tell the difference between the lake asphalt and the land or overflow asphalt.

Mr. Lewis: There are several ways in which it is claimed it can be determined. Judging from our investigations I am led to believe that the most conclusive way of determining it is by ascertaining the amount of asphaltine and petroline. All samples which we have analyzed show this pretty clearly. Here, for instance, is a table giving some analyses of refined asphalts:

Source	Petrotine	Asphalline	Total Bitumen	Other organic matter	Mineral matter	Per cent. of total bitumen	
						Petrol.	Asphalt.
Trinidad Lake	39.440	16.348	55.788	8.741	35.471	70.696	29.304
Trinidad Land	37.123	16.597	53.720	9.393	36.887	69.104	30.896
Bermudez....	72.893	21.677	94.570	2.790	2.640	77.078	22.922

Mr. E. Adam, Newark, N. J.: I would like to ask Mr. Lewis which of the asphalt pavements in the city of Brooklyn has so far stood the best tests, or what asphalt gives the best satisfaction, that of the Trinidad, Lake, Land, the Alcatraz or Bermudez?

Mr. Lewis: The time is too short. It was only last year that we opened the doors to different kinds of asphalt. Up to that time we had taken what contractors gave us and called it Lake asphalt. Whenever there happened to be a poor piece of pavement, they were likely to proclaim it land asphalt. Possibly it was, but I am somewhat skeptical on that subject. I will say, however, that two or three streets paved under contracts for land asphalt are at present as fine specimens of pavement as we have ever had in Brooklyn. I think there is no question as to the merits of Bermudez asphalt. As to the Alcatraz, I do not like to give any judgment yet. Some of it was not very satisfactory. I do not venture to answer Mr. Adam's question at the present time, although the vast majority of our pavements are Trinidad Lake, and I think as a rule they are very satisfactory. There is no question about that material. It is way beyond the experimental stage, but I believe some of the best asphalts laid in this country are laid of what is called land asphalt.

MR. HATHAWAY, Marietta, O.: I would like to ask Mr. Lewis what the cost is in Brooklyn per square yard or foot of asphalt pavements?

MR. LEWIS: Well, it is too low, almost. We have had very keen competition on the part of five companies. We take our bids in an unusual way, a price per square yard for the wearing surface, and per cubic yard for the concrete foundation. The Alcatraz Company has not less than twenty-five contracts, yet unfulfilled, under which they are to receive $1.00 per square yard for wearing surface, with a five-year guarantee, and from $3.60 to $4.00 per cubic yard for the concrete foundation, which for six inches in thickness would make the total cost about $1.55 a square yard. The prices this year are somewhat higher, but as a rule they are not over $1.85 a square yard for any of the asphalts, including concrete foundation.

MR. VAN DUYNE, Newark, N. J.: The point that some of us would like to get at clearly is just what the cost to Brooklyn is for the whole work. I notice the specifications of cities vary greatly. We in Newark call for one bid per square yard of paving. This includes the excavation necessary for the paving, the concrete, the binder and the top surface, all in one. Now we are not clear as to whether or not Brooklyn's bid covered all those items, and that is what we are trying to get at.

MR. LEWIS: I will say the prices I mentioned covered everything except the setting of the curb and the laying of the concrete foundation.

MR. STAINSBY, Newark, N. J.: Will the gentleman give us the figures of laying the concrete?

MR. LEWIS: From 60 to 70 cents per square yard. It is paid for by the cubic yard, $4.20 per cubic yard being about the highest price, which would be 70 cents per square yard. About $4.00 is the ordinary price. If you want full details I have here a report for last year in which the whole thing is boiled down, with all incidental expenses.

THE PRESIDENT: That we may understand, will you please give the convention the thickness of your binder and the thickness of your wearing surface specified?

MR. LEWIS: Ordinarily one inch binder, two inches wearing surface. We also, I am sorry to say, laid some with four inches of concrete, which we will never do again, although there is nothing the matter with it thus far. As to that cost, here is a street (referring to report), with a roadway twenty-four feet in width, concrete foundation, six inches, one-half inch cushion coat, wearing surface two inches.

This is one of our earliest contracts when the price for wearing surface was $2.09, including the removal of an old asphalt pavement laid on wooden block. The total cost, including curb, inspection, etc., was $2.54 per square yard. The inspection amounted to $80, or somewhat over 2 per cent.

Here is another one laid over cobblestones (we do a little of that still) with a coal tar binder, one inch thick, asphalt surface two inches thick, which cost, including curb inspection and everything, $1.84 per square yard or $6.79 per linear foot for a carriageway 34 feet wide. Here is one taken at random, with concrete foundation, four inches thick, asphalt binder 1½ inches, wearing surface 1½ inches, total cost, including everything, $2.24 per square yard, or $5.98 per linear foot with a 24 foot roadway.

MR. VAN DUYNE: I do not think we have got what Mr. Lewis can give us yet. Take what he considers a standard asphalt pavement, we will say with six inches of concrete that he referred to as the best, and perhaps an inch or an inch and a half binder and two inches wearing surface, what does that cost?

MR. LEWIS: One dollar and eighty cents per square yard, or, perhaps, $1.85. That includes the concrete, removal of cobblestone, grading, everything except the curb. One dollar and eighty cents, I should say, would be an average for a six-inch concrete foundation at present.

MR. STAINSBY: I would like to ask if that is all, because we are paying a great deal more than that.

Mr. Lewis: That is about the average of all kinds of asphalt, Trinidad, Pitch lake or overflow Bermudez or Alcatraz.

Mr. Frank V. Matty, Syracuse, N. Y.: I would like to ask the gentleman if it does not make a difference as to the grade of concrete that is used. Some engineers use a better grade than others, that is, they used more cement, making the concrete more expensive. I know that from experience in our city; in one street the concrete alone increased the amount of the bids some 14 cents a yard. I would like to ask him if that is not a fact, if it does not make a difference in the amount of cement that is used?

Mr. Lewis: Our figures are for the best quality of Rosendale cement concrete. That is good enough for any purpose, unless you want, for special reasons, a very special result. It is mixed in proportions of one part of cement, two and a half of sand and five of broken stone. Although our formula was 1-2-4, we are getting nearer 1-3-5. I think 1-3-5 is a better mixture than 1-2-4.

Mr. Guthrie, Buffalo, N. Y.: I would like to ask Mr. Lewis whether in testing asphalt, given two samples of asphalt, one from the lake and one from the land, or overflow, can you, from the tests so far obtained, trace those two asphalts to the proper source? Can you tell which is from the lake and from the land, from physical and chemical tests?

Mr. Lewis: We have not as yet found any conclusive physical tests. The most noticeable differences we have yet found is in the relative percentage of asphaltine and petroline. That seems to be quite constant. I have not found any other marked difference.

Mr. Matty: Do you make physical tests?

Mr. Lewis: We do not make many physical tests.

Mr. Matty: I would like to ask another question. Do you place an inspector at the various plants of the contractors making the mixture, so as to know he is doing exactly as he is required to do?

MR. LEWIS: We do not keep one at each plant all the time. We have only one man that does that work.

MR. RUNDLETT, St. Paul, Minn.: There is one question I would like to ask Mr. Lewis in order to arrive more definitely at the relative cost of asphalt pavement in Brooklyn and St. Paul. I understood him, the contractor guarantees the pavement for five years. In addition to that, does he also submit any bid for keeping the pavement in repair after the term of guarantee has expired? In St. Paul all our specifications require a guarantee for a term of ten years and after that they give a bid to keep it in repair for, a certain specified time, for which the price bid has varied from five to ten cents per square yard per annum. The last two years the price of pavements has varied considerably. Last year under competition with the Bermudez Company we had asphalt laid as low as $1.95. This year the price has been higher, averaging about $2.45. Now to get a comparison, I would like to know what the guarantee price is for any term in addition to the first five years, as of course it is worth more with a ten than with a five year guarantee.

MR. LEWIS: We have never received, in connection with a bid, a proposal for the maintenance of the pavement after the expiration of the guarantee for either five or ten years. I have looked up all the bills. I could find none for repairs which have been made in the city. Our repairs in the past have been made in a very illogical way. When a hole became dangerous, it was repaired. So long as it was not dangerous it was let alone. The consequence was that we did not have good pavements. Our streets were in constant state of bad repair. The work done amounted to about four cents per square yard per annum. Very few of our pavements are over ten years old and the average cost of repairs after the expiration of the five years guarantee has been about four cents per square yard per annum. I hope to be able to obtain legal authority to make contracts for maintaining for a term of years and I confidently expect that, as the mileage of asphalt increases and the traffic resumes its normal volume, we can keep the expense of thorough maintenance down to four cents per square yard per annum.

Mr. J. H. Pearson, Louisville, Ky.: I would like to ask Mr. Lewis if in Brooklyn he has used any of the rock asphalt, the native rock asphalt of this country? In Louisville we have been in the unfortunate predicament of having only one company, the Barber Asphalt Company. They have had no competition and have controlled everything. In the last few months, we have had the Breckenridge Asphalt Company, which is really the same company, I understand, as have laid about ten miles of rock asphalt in Buffalo, N. Y. We have just completed two streets with Kentucky natural rock asphalt and I would like to know if some one else here has any of it in his city and what he thinks of it.

Mr. Lewis: We have two samples of this Kentucky rock asphalt which was laid some years ago. Now no one seems to take any special interest in it and it has been extensively repaired with Trinidad Lake asphalt.

Mr. Pearson: I would like to ask if there is any gentleman from Buffalo who can give us any information of the rock asphalt they have. I am familiar with the gentleman who did the work there, and the best information I can get is that it has given entire satisfaction. I understand (although I cannot say whether I am right or not), but I understand the rock asphalt is practically the only asphalt that is used in Berlin, Paris, and perhaps in London. In other words, there is very little of the lake or land asphalt used in foreign cities. I would like to say that some ten or twelve years ago we had a small strip of Kentucky rock asphalt, with a small mixture of German limestone asphalt rock, laid in front of our Adams Express building in Louisville. It has not had a single dollar's worth of repair to it from that day to this. It is in perfect condition except, where the limestone curb joined it, the limestone gave way and it leveled itself down to conform to the stone. The work that we already have completed on one of our streets with Kentucky rock asphalt appeared to be very soft at first, but every day it grows harder and harder and the marks of the wagons disappear, and *we* think we have got a very good thing at a very low price.

A MEMBER: I think it is useless to sit here and try to listen unless the gentlemen will speak louder. I think the gentlemen should bear in mind that this hall is quite large and it is necessary in order to be heard to try and speak louder.

THE PRESIDENT: I would request the members to come forward, and I wish to ask those that are going to participate in the discussion, who happen to be in front, and in the center, to come to the front so that they can face both the audience and the reporter. It will facilitate the work and properly accommodate everybody. Those on one end or the other can remain where they are and make themselves understood.

MR. GUTHRIE: In answer to the gentleman's question as to the rock asphalt used in Buffalo, I will state, as to Kentucky, which is a mixture of bitumen and sand, that by itself it has not given satisfaction after being laid about five years, but when mixed with other asphalt it has given good pavements. With regard to other rock asphalt, we have had some experience with the German, which has given good satisfaction, but is more expensive.

A MEMBER: I would like to ask Mr. Lewis whether it is not a fact that our asphalt pavements are generally too flat? Should they not be more round than they usually are?

MR. LEWIS: Of course if a street has a very light, longitudinal grade, it is necessary to have it more convex to get the water into the gutter and keep it there. But as long as the water does not stand, as long as your gutter is well formed, and the water will run off after a reasonable time, I do not attach very much importance to the crown, and, besides that, a high crown makes it very like harder for the horses. I prefer to have the cross section as flat as possible and secure good drainage.

MR. E. H. KEATING, Toronto, Can.: I would like to ask Mr. Guthrie with reference to German rock asphalt. He has referred to the additional cost of the German asphalt. Now, in Toronto we have had some negotiations with a German company and they have contended that, if we would lengthen the term of the guarantee from five to fifteen years, they could enter successfully into competition with other asphalt companies. They contend that their asphalt is a superior article and that they can guarantee it for fifteen years, while other asphalt companies can guarantee theirs for only five years. I think the usual practice in a number of cities is to ask for a five year guarantee only, while some require less. In Toronto we have a number of asphalt pavements, about fifteen or sixteen miles, perhaps a little more. Some of those pavements are over five years old and are in very good condition, while other newer pavements are not so good. They are all made of Trinidad asphalt, some are land asphalt and some are Pitch lake. The guarantees on some of these pavements are just about expiring and I am met with the difficulty, at once, of the condition in which some of these pavements are. We find them cracked sometimes in blocks of four and five feet, or something like that, that is, the cracks would be four or five feet apart, and occasionally some of them are a little open. I have called upon the companies to resurface some of these streets, or portions of them that are badly cracked. The companies have objected; they think that I am asking something unreasonable. I wish to ask this convention what the usual practice is in other cities.

I am also met with the difficulty of some of this asphalt disintegrating or rotting. I made inquiry here yesterday at the City Hall on this subject, and I was surprised to find from some of the officials that they had not known of any of the Trinidad asphalt pavements in Chicago being affected in that way. I should like to hear the experience of other cities in this respect. I was told that that decay was due to impurities, tar and mixtures of tar, with the asphalt. I do not think there is any coal tar or tar mixture with our asphalt. We had inspectors on the contracts and at the works and they have never reported any attempt on the part of the contractors to adulterate the mixtures. I also noticed in some places where we had cut out the pavement for repairs where it had become wavy or uneven (of course it was in such cases thin in some places and thick in others), that decay seemed to commence from the bottom, and while the pavement was fairly good on top, although, as I have said, a little wavy, that decay had evidently set in from the bottom. Now, I should like very much to hear what the experience is of other cities in that respect. It is the first instance of the kind I have noticed, and only about a month ago. I think the subject a very important one and I hope it will receive full discussion here.

Mr. Adam: We have a street, that runs along on the Market building, paved with asphalt; the brine that comes from the fish stands in the market runs over the asphalt pavement, and in two years the brine had rotted the asphalt pavement adjoining the building. The Paving Company replaced it.

Now as to the guaranty of five years. I have also always contended, like Mr. Lewis, that a five year guaranty is only a nominal one. I think every city ought to insist on a ten year guaranty. I think any company would be willing to give five years, but, as the gentleman from Toronto has said, some of the companies who now lay asphalt under a guarantee of five years would hesitate if fifteen years should be exacted. In our city the condition is the same as in many others. We have not entered upon an agreement with any company to keep the asphalt pavements in repair, although the guaranty of five years has expired upon some streets. The necessary repairs were made before the time had expired, so that they are now in good condition. But the city does not know what the company is going to charge for keeping the streets in proper condition. They think that it would be a great detriment to ask for a longer guaranty than five years, because the property-owners would hesitate to petition for asphalt pavement on account of the increased cost. They would like to keep the price as low as possible, so as to induce the property-owners to ask for asphalt pavement. I must say that we have laid considerable in the last few years, and it seems to be growing in favor with the people; they like it. We have taken up cobblestone pavement and put down asphalt and the property-owners are assessed for about three-fourths of the whole cost. Where a pavement is put down for the first time, we somewhat labor under the same conditions as prevail in New York City or Brooklyn; where the property-owners pay for the first pavement, they try to get as cheap a pavement as possible. I understand the same custom prevails in Chicago; the abutting owners are perfectly willing to take up with the wooden pavement, because it is cheap, and when this is worn out they want an asphalt pavement, because then the city has to pay for it.

Mr. Keating: In the last asphalt pavement contract let in Toronto I lengthened the guarantee from five to ten years to ensure a better class of work and to get over this difficulty experienced with some of the pavements that are now falling due. To my surprise, and no doubt to the surprise of this convention, the price was not appreciably increased. I cannot explain it, unless it was on account of the competition which was being brought in by the clamor for brick pavements, but there the fact remains, that for the last pavements we let on a ten year guarantee, the price was just about the same, or little more, than that previously paid on a five year guarantee.

The President: How much?

Mr. Keating: It was a lump sum contract but the price would be about $2.75 a yard.

Mr. B. J. D. Jeup, Indianapolis, Ind.: In the city of Indianapolis we have the Western Pavement Company and the Woodlawn Asphalt Company, and in 1895 the price bid per yard was about $2.25 a square yard, two inches wearing surface. Within the last year we have increased the guarantee to nine years, and, although the asphalt companies thought it was an exaction, they bid $2.20 a square yard. We have had all our pavements laid this year under that kind of guarantee.

Mr. M. M. Drake, Buffalo, N. Y.: For the purpose of comparison of the cost of asphalt pavement, I would like to ask the gentleman to specify just what the work consisted of, whether it included the grading and the pavement in toto. I would like to ask especially the gentleman from St. Paul.

Mr. Rundlett: The pavements that were laid last year were all renewals. Cedar block pavements had been down on the streets previously and had worn out. The price given includes the removal of the old pavement, but that was practically no expense to the contractor, because the street was thrown open to the people to gather up the old blocks for firewood, so really the cost to the contractor consisted in leveling up the old road bed and putting down concrete foundation and asphalt surface, which consisted of an inch of binder and two inches of wearing surface.

Mr. Drake: I would like to ask the getleman from Indianapolis what the price included.

Mr. Jeup: It included six-inch base and the asphalt surface. It did not include the grading or the curbing.

Mr. A. D. Thompson, Peoria, Ill.: In response to the request of the gentleman for detailed cost of work, I will say that the asphalt pavements in our city, using nothing but Bermudez or Trinidad Pitch Lake asphalt, cost during the past season from $1.84 to $1.90 per square yard. The asphalt is 2½ inches thick, laid with a cushion coat one-half inch and wearing surface two inches thick, upon a 6-inch concrete foundation. The concrete is composed of one part natural hydraulic cement, 1½ parts sand, and 5 parts broken stone, the particles of which range in size from one-fourth of an inch to two and one-half inches in the greatest dimension. The price per square yard includes the wearing surface, concrete foundation, excavation, and a guaranty for five years, but does not include the cost of curbing.

Mr. Sherrerd, Newark, N. J.: I think that Mr. Keating's question brought up the phase of the specification question in regard to asphalt which ought to be considered by the convention and discussed. I had the same trouble while City Engineer in Troy, New York, in 1892, in determining just what the asphalt companies ought to do in the way of repairs. The contracts that I now refer to were for "land asphalt" and the guarantee was in the shape of twenty per cent. of the contract price retained by the city, and invested in bonds. The contractors were to receive the interest on those bonds every six months provided the pavement was in perfect condition. After two years there were some cracks developed somewhat similar, though perhaps not as numerous as Mr. Keating described, and then the question was as to what repairs were to be made before the interest could be paid, and the company, after being punched up several times, repaired these defects by cutting out the cracks about three inches each way, and putting in new asphalt, which seemed to be all right for that year, but after the winter season each year cracks would again generally appear at these points. I think the specifications should contain something more definite than is usually the case, in regard to how thick the asphalt ought to be and to what extent cracks may be allowed at the end of the guarantee period, or something of that kind.

MR. STAINSBY: I would like to ask some questions of the gentlemen from Buffalo. They have had as much experience as any city outside of Washington, if not more. I would like to have them state the costs of laying pavements in Buffalo.

MR. GUTHRIE: I would state that the cost has uniformly been $3.00 per square yard, including wearing surface and curbing, and the last two or three years, including all regulations of manhole tops, receivers, etc. On working up a vigorous competition, that price has been brought down to $2.45.

MR. STAINSBY: The gentleman speaks of curbing. In our city it is a distinct item in the contract, and, therefore, we, of course, have to pay for it. I would like to know what he means by curbing, what curbing he puts down and what is the price of curbing if put down outside the contract?

MR. GUTHRIE: Sandstone curbing about thirty inches deep, thirty inches long, four inches thick, price about 45 cents per linear foot, that, for a thirty-six foot pavement, would be about 23 cents per square yard.

THE PRESIDENT: As it seems that some of the delegates present are anxious to get some comparative information as to costs, I will give you our experience in Milwaukee. We specify six inches of concrete, consisting of one part of cement, two of sand and four of broken stone, one inch binder, and two inches wearing surface, deducting from the measurement all kinds of manholes and other surfaces on the street, taken up by corporations, like tracks and anything of that kind. A guarantee of five years is required. The price on that kind of pavement has been from $1.95 to $1.99. Understand, this does not include curbing, but includes the necessary grading on streets where railway tracks are laid. In the center of the city we specify seven inches of concrete, one inch binder, two inches wearing surface and a brick gutter consisting of Hayden blocks twenty inches in width along each curb. For such pavement we have had to pay, including a five-year guarantee, from $2.31 to $2.34 per square yard, This work includes the laying of a granite course, or a course of granite stone furnished by the railway company along the inner line of rails. That, however, is not measured in with the asphalt pavement, while the brick work is measured and paid for as asphalt pavement.

MR. STAINSBY: Does the city pay for paving inside the tracks?

THE PRESIDENT: We do in the original pavement. We have not had asphalt long enough to require its being taken up again excepting in one case where the track was taken up by the railway company in order to put a concrete foundation under their ties. The railway company, however, after the pavement has been once laid, is obliged to maintain the same between the rails of each track and one foot outside of the rails.

MR. J. J. BURKHARDT, Newark: We have heard from various delegates and cities what the cost of asphalt pavement is with a six-inch concrete. Now, I think it would be interesting for us all to know if we can in some way or other find out what the life of asphalt pavement has been up to date, that is, what the experience of the various cities has been. I think that is something which interests us materially, and I would like to know, if possible, if we can ascertain that, what the life of asphalt pavement with a six-inch concrete, has been up to this date.

THE PRESIDENT: I think there are two cities here who could give us information on that and those are Washington and Buffalo. Mr. Guthrie, can you give us any information as to the life of asphalt pavements?

MR. GUTHRIE: As to the life of pavement, I would state that one street was laid in 1879, that is, seventeen years ago, and it has had about three cents per square yard expended annually upon it from that time, and I think there were no repairs made on it until after ten years. Of course we have had a great many streets of which the life has been very much shorter. I will say that, from my experience, I do not know what the life of asphalt pavement is.

MR. MATTY: May I ask Mr. Guthrie what kind of asphalt that was?

MR. GUTHRIE: That was Trinidad asphalt.

MR. KEATING: With reference to the City of Milwaukee laying asphalt between the railway tracks, may I ask if it was found a success? My reason for asking this is that we have done the same thing in Toronto and it has not been a success, that is, on streets that have been down four or five years and in fact it has been so unsatisfactory that it has been concluded on the part of the Department not to lay any more asphalt between the street railway tracks at all, but to adopt some other kind of pavement on the track allowance.

I might say that there appears to be some misapprehension about the cost of these pavements. Wherever parties have stated that their pavements have cost so much per yard, it is necessary to know all the conditions. Now, we have in Toronto two different classes of asphalt pavements. We use a six-inch concrete base with a two and one half inch surface of asphalt, that is, including the binder or cushion coat, and we also lay on streets where the traffic is not heavy a lighter class of asphalt, two inches in thickness on four inches of concrete. This latter class of pavement, of course, is very much cheaper than the former. I might say that our prices are somewhat above any prices I have heard stated here, and the reason probably is that I think we use a superior class of concrete base. Hitherto we have used Portland cement concrete entirely for all pavements. Where a concrete base has been adopted, the mixture is one part of cement to three parts sand and six parts broken stone. Of course I am now referring to Portland cement, not any natural hydraulic cement, which, of course, would make a very considerable difference in the cost.

THE PRESIDENT: With reference to our experience of laying asphalt between the rails of street railway tracks, I would say that it has not been a favorable one where the Johnson girder rail was used and no protection given to the asphalt on the inside line of the rail. Where a granite lining has been laid along the inner line of the Johnson rail, the asphalt has given good results between the tracks, as well, I might say, as on the rest of the roadway.

MR. KEATING: Is it Trinidad asphalt?

THE PRESIDENT: Trinidad asphalt, where the tracks and ties have been laid and imbedded into a concrete foundation. Where the ties or tracks have been laid upon the natural earth, the vibration due to the great amount of travel over it has broken the concrete immediately adjacent to the rail.

MR. PEARSON, Louisville, Ky.: I would like to ask Mr. Lewis again if he has had any trouble about the immense waves that we have in our city. Since we have had the competition of the Breckenridge Asphalt Company the Barber Asphalt Company claim they can lay their asphalt without the binder at all. One member only of the company, as well as the papers I have read, all claim that it *is* necessary to have this binder course. They say they can compete with the Breckenridge Company and lay the Lake asphalt as well, if we will permit them to do away with the inch and a half binder course. Now I ask the gentleman if it is absolutely necessary to have the binder in order to do away with the waves. Repairs cost us like everything, and we would be only too glad if we could get our repairs done for four cents. We have been paying about 10 cents per square yard for the entire surface of the street.

Mr. Lewis: On a number of streets the surface has become to a greater or less extent wavy. The worst instances have been on pavements which have been laid over old Nicholson wooden block, and I think it was largely caused by the mixture being a little too soft. Some of the other gentlemen say they laid a half inch cushion underneath. I never was quite satisfied that there was any advantage in that. It seems to me there might be a little more tendency for these waves to form with a smooth cushion than with a stone binder. I am disposed to think the stone binder is preferable.

Mr. Stainsby: The gentlemen want to lay their wearing surface on the concrete direct, without any binder or cushion boards, or anything of that kind.

Mr. Adam: I am of the same opinion as Mr. Lewis. We have been laying binder-crown for the last two years before we laid it on a cushion coat; the latter method made the asphalt quite wavy. I am of the opinion that the binder course is an improvement.

Mr. W. G. Wilkins, Allegheny, Pa.: We have been laying asphalt pavements in Allegheny for six years. We use no binder, but in laying the concrete foundation care is taken in ramming that it is not rammed to a smooth surface, but rather to leave it rough so that the wearing surface makes a good bond with the concrete. We have thus far had no trouble with the asphalt creeping or becoming wavy. We have about ten miles of asphalt, and it is all in very good condition.

Mr. Guthrie: I would like to state that a few years ago all our pavements, which approximated 170 miles, were laid without binder, that is only with a cushion coat. We had a great deal of trouble with the asphalt shifting on the concrete. Since that time we have been laying them with an inch and a half binder, and just last week I went over some of those street with this particular object in view, to see what condition they were in. It was only a short time, only three years, but I think the appearance of those streets was a fair indication of its good results. There was hardly any waviness, and the traffic on some of those streets was very heavy.

MR. MATTY: I believe the most important question in paving matters is that of paving between the railway tracks. I would like to ask the gentleman from Buffalo what their experience has been in that city; what material he believes to be the best to be used between the railroad tracks and the two feet outside, and the best material that can be used up to the present time.

MR. GUTHRIE: My experience has been that it would be better to lay stone toothing outside and next to the rail, provided that the rail could not be perfectly tight and rigid. If it were constructed so there would be very little give to it, I think that better results would follow, but under the ordinary conditions I think it would be a great deal better to use alternately a long and short toothing.

MR. MATTY: We have done that in Syracuse for the past six years. The first pavement laid was between six and seven years ago. Every one of those pavements, and there are several miles along railroad lines, have given us a great deal of trouble and annoyance. For the past six months we have been repairing, taking out the asphalt and allowing the railroad people to pave between their tracks with brick. Not on the outside—the outside pavement goes to the outside track—but from that on, the 17-feet over to the other track, they paved with brick. Every pavement that has been laid in Syracuse has been laid by the Warren-Scharf Asphalt Paving Company and by a gentleman named Howe. It is a land asphalt, from the same part of the country where the Trinidad comes from. These pavements have invariably acted in the same manner; every one has gone between the tracks and a little outside, and the city has been in that condition for two years. To-day we are in the same condition on some of the streets on which the five year limit has just expired, and we are now allowing the railroad people to pave between their tracks with brick. They say the reason that they do not want to repave with asphalt is that it does not wear as the oil from their cars dripping along rots the asphalt, and we have come to the conclusion in Syracuse that it is so. There is something from the cars as they claim (the oil it must be) that rots this asphalt. I would like to know if there are any delegates here who have had more experience upon this question than we have. If so, I would like to hear from them. Our people object; they pay for the whole pavement, that is, the property along the line pays the assessment; the railroad company pays for the space between its rails and two feet outside; they pay that when it is first laid. Now the people living upon the line of the improvements (and there are several miles of it) object to allowing the railroad people to pave between their tracks with any different material other than the contract is let for. The railroad people send to the Board of Aldermen and ask that they be allowed to pave between their tracks with brick, the council to name the kind of brick, and work to be entirely under their supervision, but they do not want to pave with asphalt between their tracks. Now we are in that position. The Board of Aldermen have the right to allow them to pave with brick if they will only say the word, but the people petition the Board of Aldermen, "Don't do that. We ask you to compel them to pave just as we do." And that is our condition.

THE PRESIDENT: I would like to ask the gentleman whether the track and the tie is laid in concrete foundation?

MR. MATTY: Our tracks are that are being laid now. They were not at that time, five years ago, but since that time the improved tie, 90 pounds to the yard, a heavy rail I would say, and the ties, were all laid in broken stone and in good shape, tamped up, and concrete is laid over that. That is, there is 10 or 20 inches of broken stone over the ties, and then you get your six inches of concrete over that and six inches above the tie.

THE PRESIDENT: Is there any concrete under the tie?

MR. MATTY: No sir, nothing but broken stone, about 20 inches.

MR. LEWIS: I would like to suggest that we postpone the reading of papers until that of Mr. Cappelen has been read. It seems to me that we are anticipating the subject of his paper. I think that we ought to resume the papers before discussing the subject any further.

THE PRESIDENT: I wish to state that the group of papers to be read this afternoon relate entirely to the material and the testing of material suitable for street pavements. The maintenance and repair of street pavements, etc., are the subjects that are up for this evening. Now unless there is any further discussion upon the subject proper, that is, the material and testing of material suitable for pavements, we will proceed with the next paper.

MR. VAN DUYNE: I move that the Secretary, in preparing the report of this convention, give in a table by itself the cost of asphalt paving from each of the cities represented here. I suppose the engineers of the cities will furnish it.

THE PRESIDENT: You are laying out a piece of work for the Secretary that really belongs to the Committee on Street Paving.

MR. VAN DUYNE: I think that a line from each engineer from the cities represented would give us the average cost, and it would be a source of great information to all of us.

THE PRESIDENT: I will recognize the request and refer the same to the Committee on Street Pavements. If, as I have indicated in the address, a Committee on Review should be appointed and added to the standing committees, the duty of that committee would be to take up that matter and bring it before you in a tabulated form.

MR. STAINSBY: The only trouble I see is that, according to the statement of almost every member of this convention, the city of Newark is paying too much for their asphalt paving. We have been doing a great amount of that. We have paid as high as $2.71 just for excavation, and that does not include the curbing. We are now paying $2.52; the very least that we have ever paid is about $2.50; that does not include the curbing; it merely means the excavation of the street and so on, of putting on the asphalt.

There is one word I want to say in regard to the binding. We tried to bind with one-half inch binder a small street in our city called Camp Street; we had to take it up to put in a water pipe, and we found that the asphalt in some places was three inches thick and in others one-half inch—it had this wave as spoken of by the various gentlemen. Now we have abolished that entirely during the last two years, and I believe it is better for a good pavement to have an inch and a half binder, for this reason: they put on a heavy roller, the binder is driven into the concrete, and then, when the asphalt is put down, it runs into the asphalt binder and makes a complete job.

I would like, for the benefit of all of our cities, to add to the motion of Mr. Van Duyne, that in the report we could have every person give the prices paid by their cities. You can see how beneficial that would be for the cities paying those prices, because the men who are doing our work are the same men that are doing the work for everybody here. It will be some time before this report comes out, and we might have the principal cities, like Buffalo or Washington or Syracuse, where a great deal of pavement is being put down, give their figures.

MR. CAPPELEN: I would like to state for the benefit of the Newark gentleman, that I have a statement made this year of thirty cities, giving the cost of asphalt, the cost of concrete, binder, cushion, etc., and I shall be glad to refer that to you. I will see that it is brought here before Saturday. (See table, end of proceedings.)

THE PRESIDENT: Is there any further discussion upon this? If not, we will proceed to the reading of the next paper, which is by Mr. S. J. Hathaway, of Marietta, O., Chairman of Street Committee on "Paving Streets with Brick."

Mr. Herrmann here took the chair, and Mr. Hathaway read the following paper:

PAVING STREETS WITH BRICK.

BY S. J. HATHAWAY, PRESIDENT COUNCIL, MARIETTA, O.

When you see the title of my paper, I expect you will feel a good deal as the reading public did when they first saw a work on Venice by William Dean Howells, and wondered if anything new could be said about Venice; or perhaps you may feel like the regular frequenter of a nameless church, who prepares himself for his regular morning nap when the preacher starts in on his sermon. Street paving, it is true, is a familiar subject, and if I had the art of a Howells I might hope to interest you by the mere force of the rythmic run of clever English and thus make a most commonplace theme interesting. I have not that art, but I shall hope to keep you from going to sleep during my sermon.

There are a large number of cities in this country which either contemplate street paving or have already done some work of that kind.

The methods adopted are at first likely to be crude. Better and more economical ways are only learned by precept and practice; and often by comparing notes with other cities.

There are certain features of street paving relating to durability and cost that will be discussed probably as long as such pavements shall be laid.

Perhaps the shortest way of introducing the subject will be to introduce you to the mode of procedure in Ohio: We have laws which enable us to assess the cost of street improvements on the abutting property. This, however, does not include the whole cost. The street intersection and one-half of the frontage along parks and public grounds; also, at least 50 per cent. of the entire expenses are paid by the city.

The first step is to have the City Civil Engineer prepare an estimate of the work proposed, showing the total probable expense, and if approved the City Council then orders the engineer to prepare plans, profiles and specifications. When these are submitted and adopted the Council passes what is called a "necessity resolution," declaring the improvement to be necessary, and stating the width, materials and parts of street to be paved. This must pass the Council by at least a three-fourths majority of all the members elected to that body. The resolution is then served personally by copy on every lot owner along the street, same as a summons from a court, and the person serving same makes a return to Council, duly sworn to, showing in what manner each was served. Thirty days from date of serving the last property owner are given lot owners to examine the plans and profiles, if they choose to do so, and file their claims for damages if they may have any, or to make such objections as they may decide upon. At the expiration of the 30 days, any claims for damages that may have been filed are examined and if no serious obstacle appears to stop the improvement the Council passes what is known as a paving ordinance which commits the city to the work.

The Council next advertises for bids for four weeks. The lowest responsible bid is then accepted, or perhaps all are rejected and a new advertisement inserted.

The laws of Ohio require that before any contract shall be executed the money to pay for the work shall be in the city treasury. To carry this out requires a liberal estimate to be made of the total expense, and assessment bonds to be sold, in advance. These bonds run for 10 years, 1/20 coming due every six months, bear interest at 6 per cent. and are payable, principle and interest, in gold. To meet these bonds when they become due, each lot owner according to his frontage is required to pay an assessment. He may either pay cash down, or pay 1/20 every six months, during the ten year period. These assessments fall due at the same time as the taxes in June and December of each year.

The paving committee of the City Council has a general oversight and charge of the work. The City Civil Engineer is the superintendent. This is the method adopted by the city of Marietta in which I live, and where I have served as chairman of the Paving Committee since we began street paving in 1891, and so far as I can find out it is the same method followed by all Ohio cities, except a few of the larger ones where the fierce contention of political parties have induced them to seek relief through "ripper bills," and change the normal organization provided by the municipal code and by reorganization take the power out of the hands of the City Council and place it in the hands of Boards claimed to be non-partisan.

In our city, however, politics do not enter into the city elections, and so far we have not had the troubles incident to politics in large cities. The same is true of four-fifths, at least, of the cities of Ohio. This is as it should be, for contracts involving such large amounts of money as those for street paving generally do should be handled with the utmost economy and honesty, regardless of political favorites. It is the lot owners' money, some of them in very moderate circumstances and all of them very anxious that the best results possible shall be secured for the money they are forced to pay.

Twenty per cent. of the contract price is retained until the job is finished and accepted, when the contractor is required to give a bond guaranteeing the work and materials for five years. Our mode of procedure may be like that of many other cities and the recital of same here may seem tedious, but the only way to compare methods and decide which are the best is to get right down to business and go over the details. I think we came here for business and our constituents, the people who sent us here, expect us to go into an impartial investigation of all these matters relating to municipal improvements.

The streets of Marietta are quite wide, most of them being 83 feet. Two are 115 feet and one 150 feet in width. This last was named for General Washington by the early settlers, many of whom had served in the Continental army, and so named the broadest street for Washington.

The Ohio Company which founded Marietta was formed in Boston at the Bunch of Grapes Tavern March 1st, 1786, and having the narrow streets and cow-paths of Boston before them as object lessons, they resolved that the new city they were about to found at the mouth of the Muskingum, should have amply wide streets. Well, we have got good wide streets but it costs a great deal to improve them owing to their extra width, but we are thanking those wise associates of the Ohio Company more and more as time goes on for giving us such broad thoroughfares. "They builded better than they knew."

On the main business streets we pave 50 feet in width, on other streets 40 feet. One street has been paved 24 feet in width but there has been complaint ever since about its being so narrow. Teams can not turn around easily on such a narrow pavement. Now for the work itself.

The contractor excavates one foot in depth the full width. The sub-grade is then rolled with a heavy road roller. Our specifications call for a seven-ton roller, but on Third street, the one now under contract, we are using a 13-ton steam roller, thereby securing a much better foundation. After the steam roller gets through with a square the bicycle riders can ride over the grade with as much ease as they can on a paved sidewalk.

After the sub-grade is rolled, six inches of gravel is put on, then rolled with a seven-ton roller, the steam roller being too heavy for rolling gravel. Then two inches of sharp sand is put on to lay the brick in. The six inches of gravel, two inches of sand and four inches of brick, making in all twelve inches, fills the excavation back to the established grade. Then a slight sprinkling of sand is spread on the top and broomed in and the brick are rolled with a seven-ton roller. After that one inch of sand is spread over the surface and the pavement is finished.

We use Berea curb five inches thick, eighteen to twenty inches wide, with none of the pieces less than four feet long.

The crown of the pavement is usually even with the top of the curb, with six inches depth of gutter; in other words, the height of the center is generally equal to height of curb.

The engineer always runs in two lines, one for each curb, as sometimes the curbs will vary a little in height, to accommodate varying conditions on the sides.

The curb is set in a sand cushion, two inches deep, and is backed by two inches of sand thoroughly tamped. We have never had any trouble from frost, and we have not found a better stone to wear than Berea, but any hard stone will do just as well if it can be got out in proper lengths.

The two principal points, of course, in a brick street pavement are:

1. The foundation.
2. Quality of brick.

I have now said all that is necessary on the method of preparing foundation, but as to the quality of material much can be said and something ought to be said.

Many different kinds of brick are offered. Two kinds, however, present marked differences—shale and fire clay. Both of these kinds are known to the trade in two general divisions, standard brick and re-pressed brick or block. A repressed paving brick is generally larger than a common or standard brick and is called a block. It makes little difference, in my estimation, which you use, provided they are equally well burned. One-third fire clay and two-thirds shale makes a fine hard brick. There may be other combinations, but I am only familiar with this one. We have more streets paved with this than any other kind. We also have several streets paved with Hallwood block, which are giving excellent satisfaction. One street subject to heavy traffic was paved with this block three years ago and you can scarcely find a block which shows signs of wear so far.

On the whole I am in favor of a re-pressed shale block, and believe if it had one-third fire-clay it would be an advantage. I am in favor of shale for two reasons. I live in a shale country and think if properly burned there can be no better paving material produced from clay.

If they are burned hard enough and then cooled properly, or rather, to use a more scientific term, properly annealed, as they should be, a brick can be produced which will last nearly as long as a granite block. The benefit of re-pressing is that it makes a solid compact mass which is more likely to burn hard than the ordinary product of the "pug mill." The advantage of beveling the edges is that it gives the horses a better foothold. The common paving brick has sharp edges which are bound to be broken off, so that in the course of a few years the edges present the appearance of having been roughly beveled. The re-pressed block presents smooth beveled edges impervious to water, while the raw edges of the ordinary brick broken off by travel are more likely to absorb water; but the whole question of absorption of water does not cut much of a figure, if the material has been properly burned. So in regard to water getting under the pavement, and causing the frost to displace the brick, I have the first case of the kind yet to see.

Paving thoroughfares with brick is by no means a modern invention. There are country roads in Belgium that have been paved with brick over a hundred years.

The question of durability is largely one of skill in burning the brick properly. A perfectly annealed brick, like a fine tempered piece of steel, will outlast the man who made it. I would place the life of a well made brick pavement on a residence street in any ordinary sized city at a hundred years. Indeed, it is purely problematical how long such a pavement will last. It might not last forever, but it seems to a finite understanding almost indestructible.

We have never used tar to fill in between the brick, deeming it unnecessary. It costs considerably more to do it, and in case you have to open the pavement the brick are so firmly stuck together that they have to be thrown away. Six months' use of a pavement will fill the interstices, if any should remain unfilled, with sand, as firmly as need be. We can take up our street pavement at any point and find the sand underneath dry, showing that the pavement is impervious to water.

Another important question is the cost of brick paving. Many cities before they come to the period of brick paving try various expedients by treating the streets with gravel, slag or macadam, in the vain endeavor to make a satisfactory street at small cost, and nearly if not quite enough money is thus spent in these more or less fruitless endeavors to pay for a good brick pavement.

"You pays your money and you takes your choice,"—granite block, Belgian block, cedar block, asphalt or brick, but, all things considered, brick is the cheapest and the best for ordinary traffic.

I am sure the ease with which a wheel passes over a brick pavement is a great advantage as compared with any kind of stone pavement, and it is a more sanitary pavement, for granite, Belgian or cedar block catch a great deal of refuse matter which is bound to be left to fester in the sun and cast its mal-odor into the places of business or residences and taint the atmosphere of the street with more or less danger to health. Besides that the ease with which a brick pavement can be repaired is a great advantage. Every brick is from the same mold, and always ready at hand to repair a break.

Again, the thorough manner in which a street sweeper will clean a brick pavement recommends it over all others unless it be asphalt; but it must be remembered that asphalt costs nearly twice as much as brick and therefore ought to be superior in many ways to brick.

For heavy traffic I would recommend broken stone and concrete foundation, but for residence streets gravel and sand is good enough.

To the average citizen, however, the question of cost is decisive as to material, and it turns out that brick is the favorite.

Our first improvement, begun in 1891, was of standard brick and cost $1.08 per square yard of finished pavement; Berea curb, 35 cents per lineal foot, laid in place. The next year we tried re-pressed block at a cost of $1.14 per square yard. Our last letting this summer was at 65 cents per square yard for standard brick 1/3 fire clay, 2/3 shale; and 33 cents for Berea curb. We also pay $400.00 extra for the use of a steam roller and consider it a good investment.

Since the advent of the bicycle we have had everywhere a revival of the good roads idea, thanks to the energy and enthusiasm of the bicycle clubs throughout the country.

The bicycle has come to stay and so has the determination to build good roads come to stay, and it will not down until all the main country thoroughfares are properly graded and paved. I believe it is possible to pave the country roads with brick. Let the paved roadway be sixteen feet wide, or even less, crowned slightly in the center with curb of rough stone, set down even with the surface on each side, so that in dry weather teams could take the dirt road on the side, if desirable. Some equitable arrangement between state, county and land owners could be made to meet the expense, and thus make the cost to property owners as light as possible. The property on either side of such a road would be greatly enhanced in value and the isolation of country life be reduced to a minimum. With such roads the farmer living fifteen or twenty miles from the city market could drive at a fast gait with loaded wagon, deliver his produce in town and get back home in time for supper, and do it with very little effort either on his part or that of his team.

Some one has said that the condition of the roads of a country are evidences of its progress in civilization. The same might be said of the bath-room. Yet many communities might be willing, but not have the power, to construct proper roadways or bath-rooms. Good roads and handy materials go together same as bath-rooms and water works.

First, then, well-paved streets are indices of a higher civilization. Second, they are evidences of prosperity. Third, they promote prosperity. Fourth, they add to the abutting property all they cost, and in many cases more.

It is claimed that there is but one finished country in the world and that is England, with her fine roads and well-paved streets, with her superb landscapes containing forest and field duly regulated and cared for; but England's perfection is the growth of centuries. We can not hope for a finished municipality or country side. We are too young to realize that yet; but each set of officials must act their part faithfully and carry forward all public works that fall to their lot with a view to ultimate perfection and to supply the demands of the future as well as the present, trusting that in coming years both city and country will arrive at a stage of completeness and then we shall have the best land for habitation in the world.

The Chairman: As I understand it, we are to have no further discussion until the next paper has been read, which is upon "Paving in Nashville, Tenn.," by Mr. J. L. Kennedy, Member Board of Public Works, Nashville, Tenn.

Mr. Kennedy then read the following paper:

Mr. Kennedy: My paper will necessarily be very brief. I will preface it by saying that in Nashville we do not have any authority to pave any streets and charge any part of the expense to the adjacent property holders. It is all paid for out of the general fund raised by ordinary taxation, one and one half per cent. You will see, then, that we labor under some difficulty in keeping our citizens out of debt and our people out of the mud. (Reads:)

PAVING IN NASHVILLE, TENN.

BY J. L. KENNEDY, MEMBER BOARD OF PUBLIC WORKS, NASHVILLE, TENN.

We have not much information and experience in respect to paving in the City of Nashville, of a novel character, but a brief statement of facts and opinions may possibly be of use to other members, for it is only by comparing notes and discussing these matters that our work in the future can be improved, and errors, when they exist, corrected.

We have used little or no asphalt paving in Nashville up to the present time for two reasons.

In the first place, our streets are narrow and generally not more than 32 feet between the curbs, and as most all of our main streets are occupied by one, and often by two street railroad tracks, the traffic must usually follow the spaces between the outer rails and the curbing.

The result of this is that practically the wheels all go over the same ground and such a condition is not favorable for the use of asphalt paving, as there is a tendency for ruts to be formed in the pavement. The necessary granite toothing for asphalt streets would also occupy a considerable part of the street surface. The most important reason, however, lies in the fact that our city is built on rolling ground and that we have few streets where, in places, the gradient would not be too steep for the use of asphalt. The use of asphalt will thus always be somewhat limited in our streets; although, in the future, it will doubtless be more used than it has been in the past.

We have already been making some small experiments with the Kentucky, or natural, asphalt. We have tried a small section by covering part of a macadamized street with a covering of the natural asphalt rock, broken to macadam size, and rolled smooth with an ordinary steam road-roller.

With a good quality of natural rock asphalt, this promises to make a cheap and fairly durable asphalt street. Further trials and experiments would be necessary before proceeding to any great expense.

Our principal pavement in the business part of the city is granite. This, of course, is durable and, when properly laid with first class blocks, makes a good and satisfactory pavement for that part of the city. The complaint of noise and roughness from granite pavement arises, in a great measure, from inferior or badly shaped block, very often put down in a careless or negligent manner.

A granite pavement will, of course, never be as smooth as asphalt, but there is a great room for improvement in material and construction in most cities. We recognize this fact in Nashville, although our granite paving is much better than is usually seen elsewhere. Up to this time, we have used four inch blocks—that is blocks averaging that width—but by using narrow blocks and rigidly enforcing specifications, both as to irregularities in the blocks themselves and in laying, we think we can get a fairly smooth pavement, and one adapted to our needs in the business part of the city, especially on our narrow steep streets.

Our method of procedure is to prepare a bed of about 12 inches of macadam, which is thoroughly rolled or tamped, and upon this is laid the granite in the usual way bedded upon two inches of sand, or thereabouts, and the joints filled with paving pitch averaging three gallons in quantity to the square yard of surface.

It will be noticed that we do not use concrete for a sub-foundation and the reason that we have not usually found this necessary is because rock lies close to the surface over a great part of the city, and practically our macadam rests upon this rock, so that, if the macadam is properly packed, the foundation is satisfactory.

Brick paving, which to a great extent has taken the place of asphalt with us, is used in the central residence streets, the central alleys and to some extent in the shopping streets. It is laid, practically, in the same way as granite, using less sand as a cushion, and less pitch for filling. So far the Chattanooga brick and the Cloverport brick have proved the most satisfactory; although we have used a local paving brick that promised well, but inexperience in its manufacture resulted in a want of uniformity which begins to show, now that some of it has been down for three or four years.

Brick is rapidly coming into use and whilst rattler and other tests are not to be set aside, it is only by practical use of the material that its true value can be shown.

As brick can be used on steeper grades than asphalt, Nashville is interested in this material. as a specially smooth pavement for streets where granite, from any cause, is not satisfactory.

As we have upwards of 100 miles of improved streets and alleys, it will be readily perceived that we have to depend principally on macadam streets for suburban streets. Our macadam streets are formed of eight inches of bedding rock, as we term it, and seven inches of broken stone rolled smooth with a steam road roller, a good covering of sand being rolled in as the work proceeds.

The bedding stone varies from 8 to 4 inches, and is well chinked in. The broken stone should pass through a two-inch ring.

This makes a very pleasant street for driving over, and in the suburban streets lasts 7 or 8 years with but slight repairs,—this is on streets which are not main thoroughfares.

Still there is always the objection of dust when dry, and mud when wet even if there be no great quantity of either.

The Kentucky asphalt, as a finishing coat may help us perhaps in the future construction of these cheaper streets.

Whilst, therefore, we have no hard and fast lines, we are practically using granite for our central business streets, brick for our central residence streets, alleys and special places, and macadam everywhere else.

Our streets are usually in good condition throughout the city, and complaints are not frequent. All who disturb the brick or granite or asphalt, are required to get a permit and pay for the replacing of the pavement. We find this the easiest and the best way, as the repaving is done at once by the city force.

THE CHAIRMAN: The next paper is on "Modern Street Railway Track Construction on Asphalt Paved Streets in Minneapolis," by Mr. F. W. Cappelen, City Engineer Minneapolis, Minn.

MR. CAPPELEN: I have to refer to drawings and some photographs. I have prepared a few blue prints that you gentlemen might use as far as they go.

THE CHAIRMAN: I would suggest that it may be well while Mr. Cappelen is reading his paper to exchange these blue prints

Mr. Cappelen then read the following paper:

MODERN STREET-RAILWAY TRACK CONSTRUCTION ON ASPHALT PAVED STREETS.

BY F. W. CAPPELEN, M. A. S. C. E., CITY ENGINEER, MINNEAPOLIS, MINN.

GENTLEMEN:

The traveling public to-day is very much more extravagant in its demand for comfort, and we might say luxuries, than it was a few years ago. This refers not alone to the equipment of a railroad, but also to the roadbed and track, and it is a common remark to hear that such and such a road is preferred to any other because of its easy track and well-maintained roadbed. This is as it ought to be. Upon the condition of the track depends the successful operation of the road to a large extent, also the life of the rolling stock and the safety of life and goods transported by the railway company.

What is true in respect to a railroad is even more so the case with a street railway in any of our cities, particularly where the streets have been properly improved. As an illustration in regard to demand for first-class equipment, the writer is reminded of an incident that occurred in Minneapolis during this season's Fall Festivities. A great many floats participated in a magnificent parade one evening, and amongst them appeared (placed upon a small truck) a little 2x4 street car for one mule, labeled with a large sign thus:

"We rode in this in '74 and were happy."

Immediately behind this came a beautiful, latest improved, electric car, with this remark:

"We ride in this to-day and kick."

On ordinary railroads the entire track is, practically, constantly patrolled, so that bed and track can be kept in as good a condition as the management desires. Low joints are readily raised, bad ties easily exchanged for good ones, bolts tightened, etc., as every thing is in plain view to the men in charge. The conditions are entirely different on a street railway.

After the track is down nothing is visible but the top or running surface of the rail; and when a joint sags it means the ripping up of the pavement of the street at that point to do the required work of putting track in proper alignment and to proper grade. The same is the case when removal of ties or rails becomes necessary. In addition to the cost of properly caring for the track itself, comes the cost of repairing the pavement between the tracks, it being taken here for granted that the corporation owning the street railway will at least care and pay for the pavement in the space from outside to outside rail on a double track road. The repair

bills in a street railway system operated with horses were comparatively small, although the track construction generally was poor. The cable roads made far better track construction an absolute necessity and companies that attempted and are attempting light and poor track construction for electric street railways have found or will find that the expense for maintenance of track is a big item.

The ordinary horse car weighs about 11,000 pounds, the cable car 12,000 and the electric car from 19,500 pounds to 43,000 pounds. These figures speak for themselves. The City of Minneapolis was one of the first in the United States to change its horse railway system into an electric system and made the entire change of 100 miles in one year.

The company, however, did not change track and rail very much, but used a great amount of four-inch light rail—45 pounds and 54 pounds per yard. The Johnston 78-pound girder rail was also used, and after considerable wrangling the City Council permitted the company to use the Shanghai 6-inch 70-pound T rail on some new extensions.

As most of the streets were paved with six-inch cedar block, on two-inch foundation plank, a great deal of trouble was experienced with the pavement next to the rails and between them.

The ties had to be cut down or four-inch blocks were used, etc. With the six-inch "T" rail strips of wood were placed along the rail to form the groove for the flanges of the car wheels to run in. The rails were spiked to pine ties on two-feet centers and almost anything used for ballast. (See Figure No. 1 on attached plan.)

In a good many cases cobble stones were used between rails. The City Charter, however, provides that the space between rails must be paved with the same material as the balance of the street, but the City Council would occasionally grant the company the right to do differently. After a while asphalt was ordered on certain streets and the Street Railway Company was obliged to look at the matter of track construction in a little different way, but finally got permission to pave between the rails and tracks with granite and the city put granite toothing on the outside of the rail. The six-inch 78-pound Johnston girder rail was used, but no particular care was taken in the ballasting of the tracks and the result was, of course, that it settled and the asphalt broke away after a short period.

This year several principal down-town streets were ordered paved, and the writer was delighted to learn that the Street Railway Company would do everything in its power to construct a first-class track in every respect.

For all crossings and curve work, the so-called Johnson, Pa., guaranty work was used. All switches and frogs have removable Harveyized steel pieces and it is expected that this work will stand in the worst places at least nine years. The life of the old frogs, etc., did not exceed five years, and was generally pretty bad after two years' wear. Ties were used for this part of the track and they were set in concrete and the entire intersections and cross-overs were paved with fine-cut granite set in cement mortar and the joints were filled with cement.

Plate No. 1 shows part of such intersection and Plate No. 2 shows part of a crossing where the asphalt work is done, but the granite work not yet in place. For all straight track work, sixty feet long "T" rails were used. The rail is the American Society, 80-pound 5-inch base by 5 inches high standard. Three methods of constructing the track were used, the next one being an improvement on the former, at least according to the ideas of the writer and the company.

The same company owns the street railway system both in Minneapolis and St. Paul, and the work was commenced in St. Paul somewhat earlier than in Minneapolis. The first plan was used there in the following manner: After the sub-foundation had been thoroughly rammed or rolled, the necessary slight excavation was made for a concrete beam to run longitudinally under the rail. This beam was eight inches in depth and fifteen inches wide, and constructed so that the top surface would be at the proper grade to receive the base of the rail. The beam was formed between boards. The concrete used consisted of one part Empire Portland cement, two and one-half parts of sand and four and one-half parts crushed rock. Upon the beams, after they had set, the rails were placed and tied together every ten feet with 2x⅜ inch tie rods set on edge. (See Figure No. 2.)

After the rails were lined up, the joints were welded, room being left in the concrete every sixty (60) feet for the joints. The Street Railway Company experimented last winter with the so-called Falk cast welded joints and adopted them for all the future work. The joint is made in the following manner:

The rails where the joint is to be made are first thoroughly cleaned with files and emery paper, cast iron moulds are then placed around the joint, held in place with clamp screws both horizontally and vertically. It was found necessary to have a very heavy vertical screw to prevent the joint from heaving on account of expansion due to the heat developed. After the molds were placed, the molton metal was poured and the joint thus completed. After cooling, the moulds were removed and any rough edges left trimmed off. The joint is made so that a flange way is formed in the cast. (See Figure No. 3.) The Company owns two of the so-called Cast Welding Machines made by the Falk Mnfg. Company of Milwaukee, Wis.

The cost of the machine is about $2,500.00 and the capacity 8,500 pounds per cast. The joint for the 80-pound rail requires about 138½ pounds of metal and the cost per joint is about $2.00. This includes the cost of fixing of the rails for the joint.

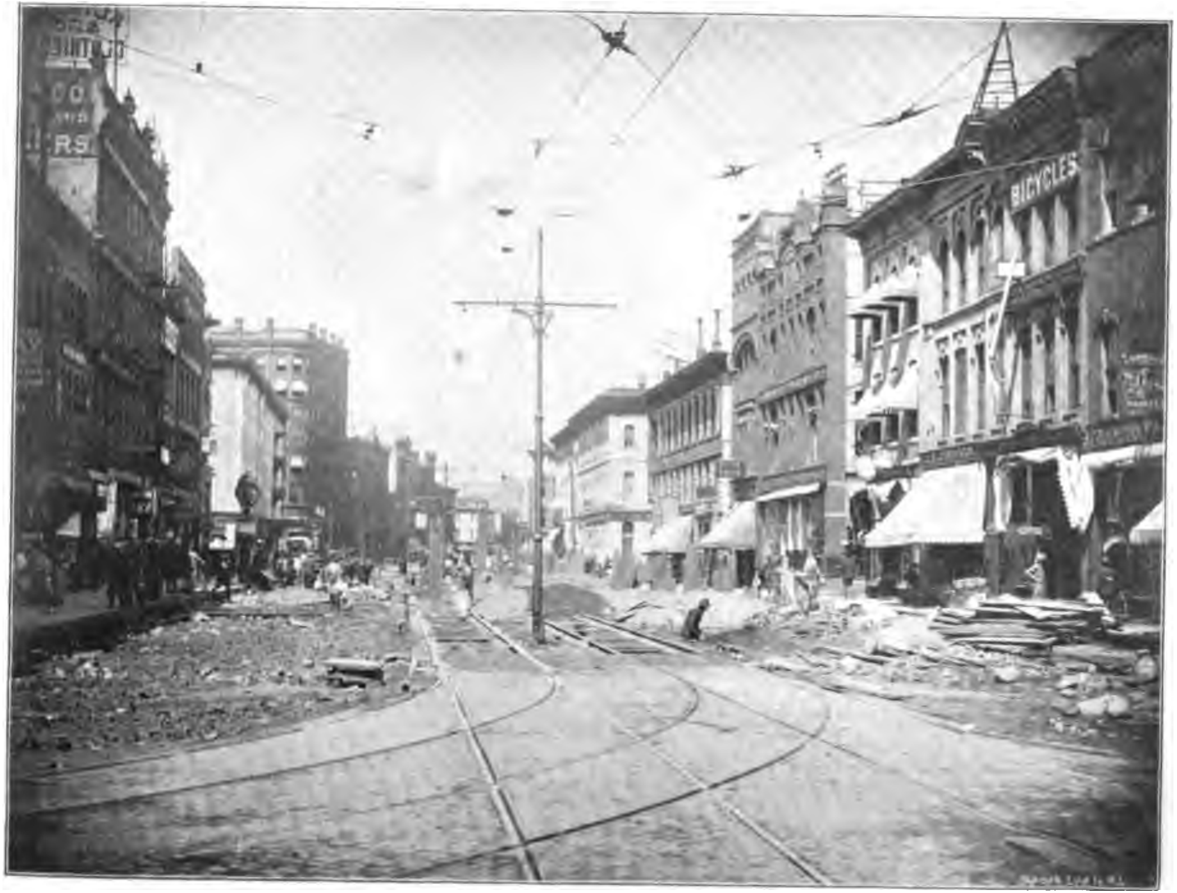

PLATE I.

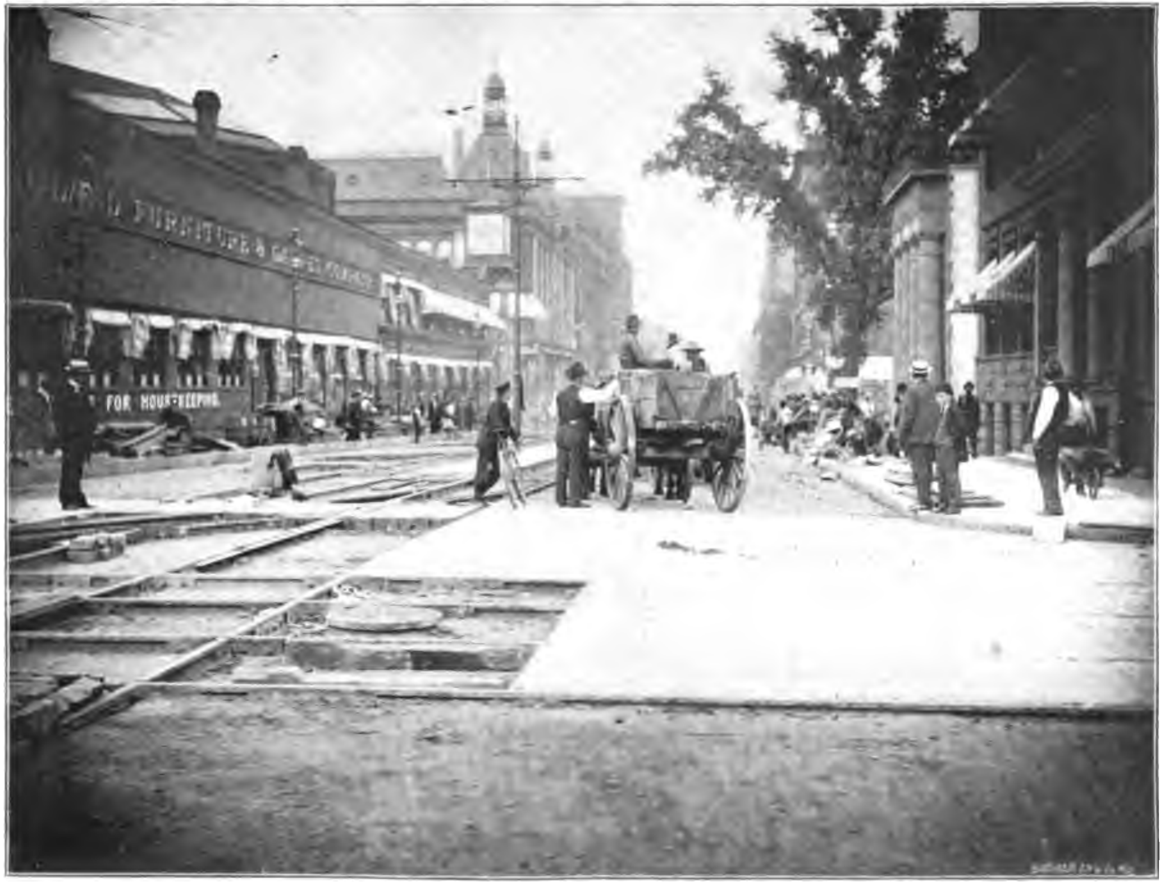

PLATE 2.

A 45-pound rail requires 102 pounds for a joint and a 54-pound rail requires 115 pounds for a joint.

A mixture of half pig and half casting scraps gives the best results. The furnace is loaded in layers, beginning with wood, coke and pig, coke pig, etc.

After the joints were made, Milwaukee cement concrete, six inches in thickness, composed of one part cement to two and one-half parts of sand and four and one-half to five parts of rock was placed to proper grade to receive 2½ inches of asphalt pavement across the entire street and between rails and tracks, leaving enough space on the inside of the rails to place along some granite blocks 4½ inches deep, 3½ inches wide, and 9 inches long.

These blocks were, however, set simultaneously with and in the concrete, being separated from the head of the rail by a 1¼-inch wooden strip, so as to form the flange way for the car wheels. After the strip was removed, the lower 2½ inches of the space left was filled with cement grout and the upper 2½ inches to the top of the rail was filled with asphaltic cement consisting of about 30% asphalt and the balance lime stone dust.

This mixture remains soft enough to form the proper groove when the first car is run over the track. The joints between the granite blocks were filled with asphaltic cement.

After the track work was completed as described, the asphalt pavement proper was put down flush to the top of the rails everywhere, but where the groove was.

Considerable trouble was experienced in St. Paul with the rails after the joints had been cast. In a little while, about 1,500 feet of track looked like a snake and it was very difficult to get the track back in line, in fact, the Superintendent of the Street Railway Company thought he would be obliged to cut off the rails, but he got along without doing so. When the work came up in Minneapolis, this matter was discussed and it was thought advisable to proceed in a different way.

Ties were placed about every six to eight feet apart, and the rails were lined up and temporarily fastened to the ties, then the cast iron joints were made, and the concrete beam put in between ties in the same manner as in the first case. The ties were then pulled out, the space filled, and the balance of the street concreted and completed as before.

The rails were also spiked to the concrete beam, as soon as it was in place. The track was kept in perfect alignment this way. After further discussing the work as it progressed, a further modification in constructing the beam was adopted. As it was not always possible to follow up with the concrete work of the street proper as fast as the beam was built, a good bond was not obtained between the beam and the other concrete, so the method was changed this way. The ordinary concrete was put down outside and inside the rails, forming a rough groove about 8 inches deep, 15 inches wide at the bottom and 18 to 20 inches at the top.

In this groove as soon as it was built, the beam concrete was placed, otherwise the construction was as in the second case.

Plate No. 3—Shows the pouring of the joint.

Plate No. 4—Shows the side mould removed.

Plate No. 5—Shows the entire joint.

Plate No. 6—Shows the cast welding machine.

Plate No. 7—Shows the beam and the rails as mentioned in the second case; also shows temporary track.

Plate No. 8—Shows track ready for asphalt.

Figure No. 4, on Plan—Shows cross-section of 80 feet street with new track construction. Figure 5, same, more detailed.

The cost per foot of rail for the beam construction only including grading for same was in the first place twenty-six cents, in the second case twenty-six cents and in the third case twenty-seven cents. The filler cost about five cents per foot.

Cost of putting down temporary ties and laying, lining and surfacing one mile of single track preparatory to putting in concrete beam, and including labor and material used in welding the joints (approximately $850.00).

In connection with this change of track construction, the writer changed the cross-sections of the streets as well as the intersections where repaving was done. All the old streets have very deep gutters, from 12 to 15 inches and even more. This made it necessary at intersections to use bridges over the gutters at the corners, making same unsightly in the first place and generally the gutters were easily filled under the bridges, and finally too much space of the street was lost.

Wherever repaving has been done, this was changed, so that now the gutters are only 6 to 8 inches in depth with corners of the streets rounded off to 12 foot radius, and the street raised at the corner so that only a step to the pavement of from 4 to 5 inches is needed.

Drainage is taken care of by putting in double catch basins. This makes beautiful intersections and pleases everybody.

On a fifty-foot roadway paved with asphalt and without tracks, 8-inch gutters and 10-inch crowns are used; with tracks, 8-inch gutters and 7-inch crown from rail; on streets before changed, 15-inch gutter and 12-inch crown. (See Figures Nos. 1, 4, 6 and 7.)

The cost per mile of a double track constructed as related would be about:

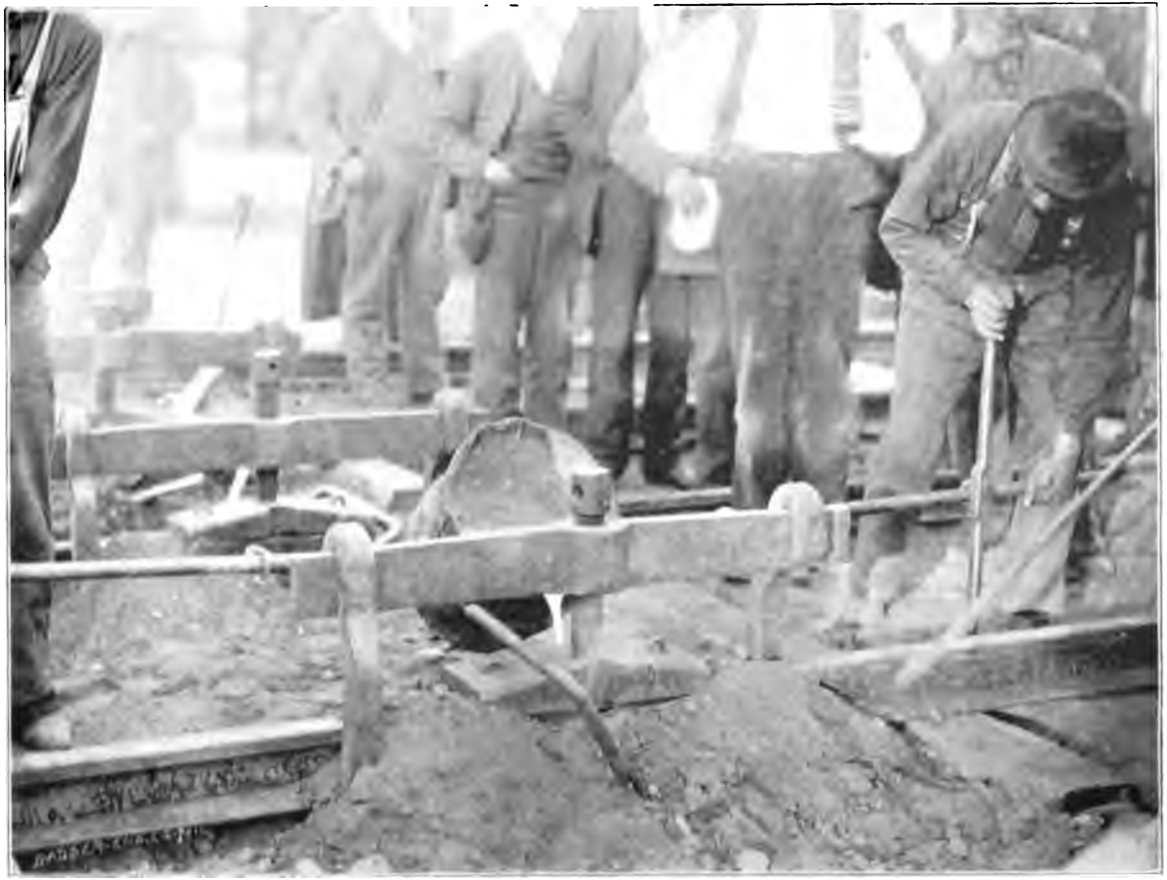

PLATE 3.

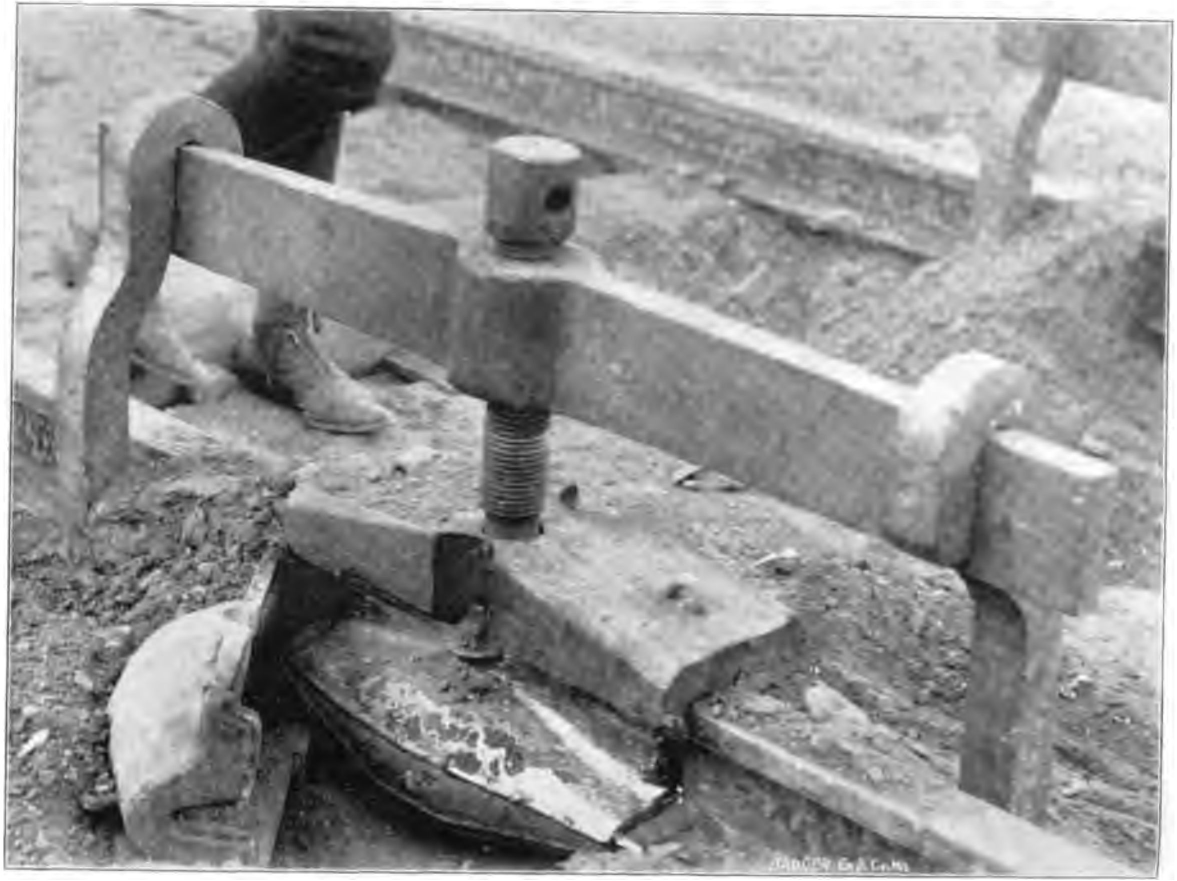

PLATE 4.

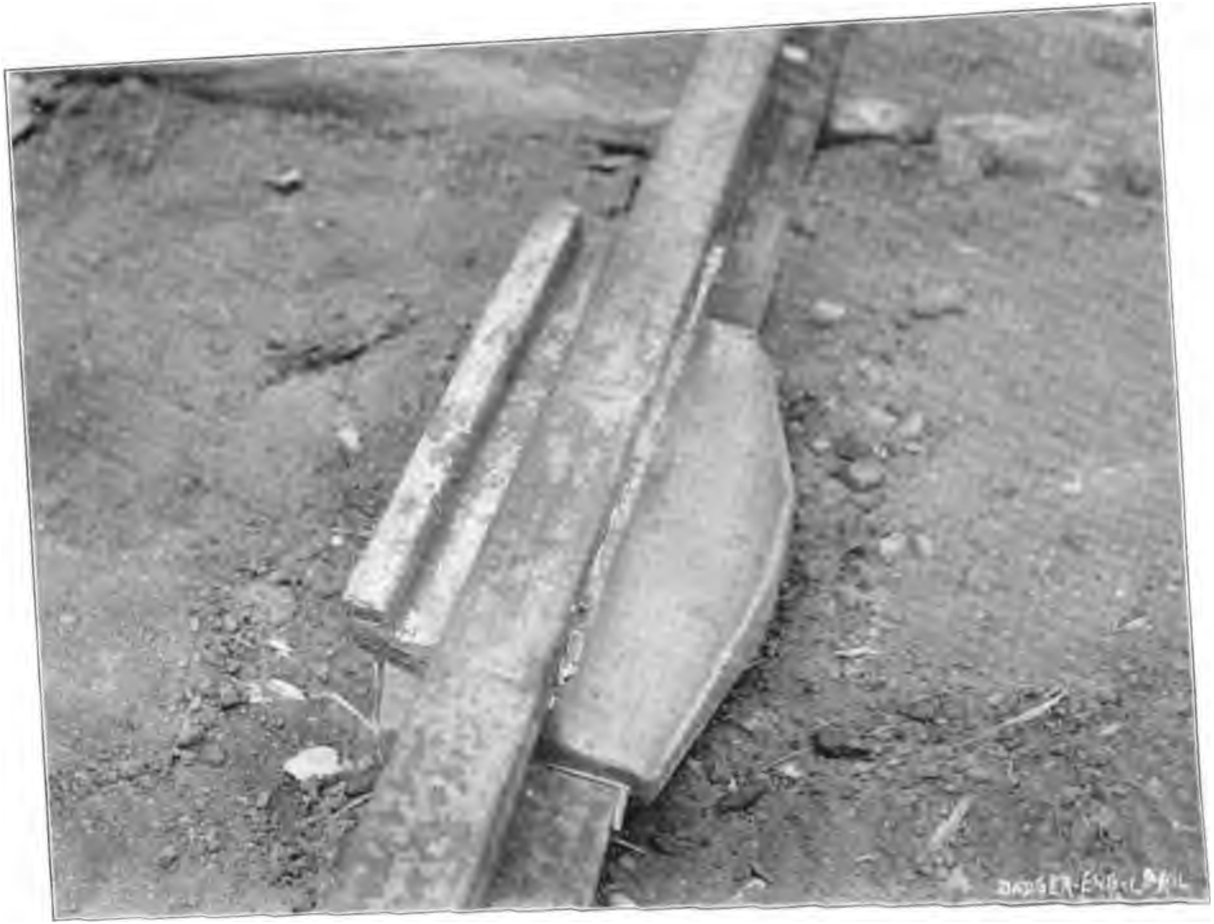

PLATE 5.

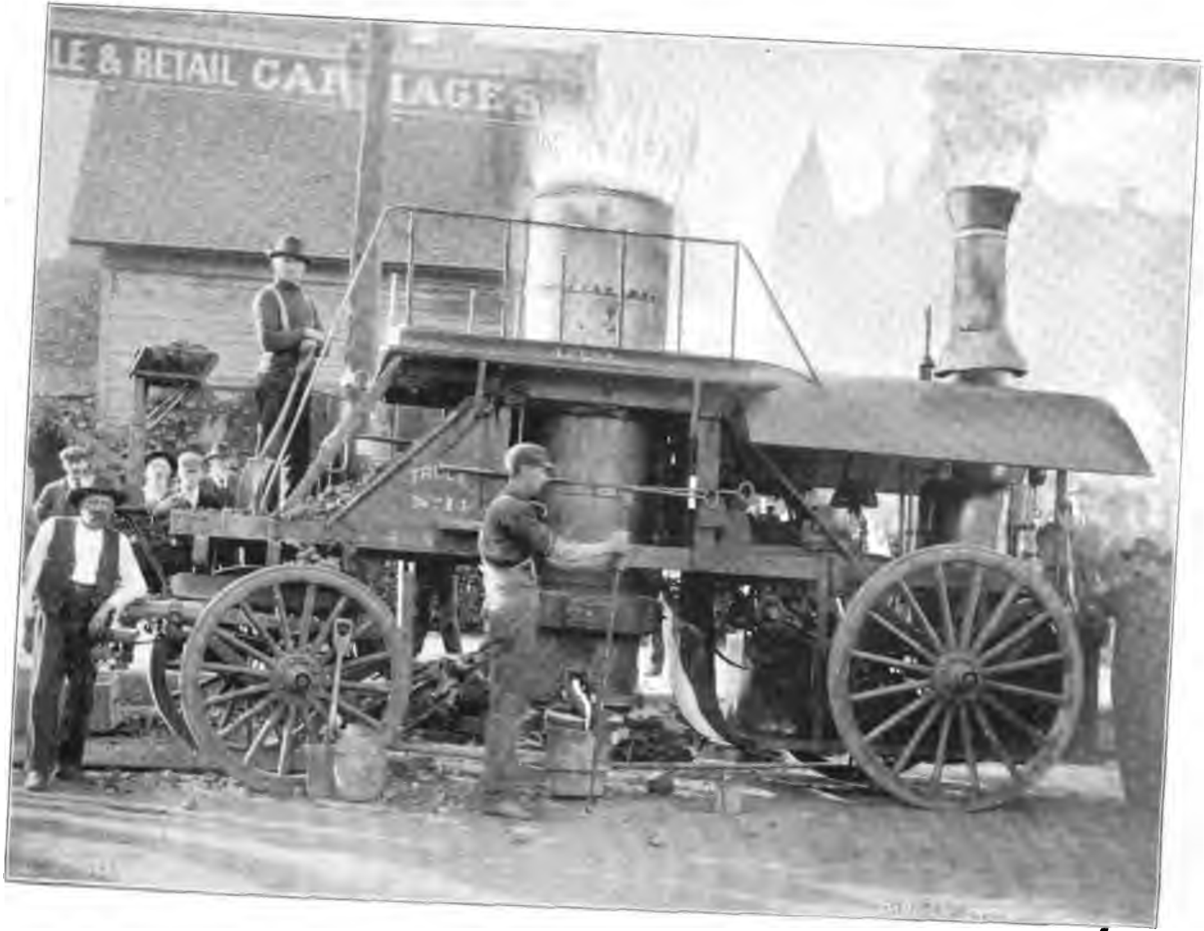

PLATE 6.

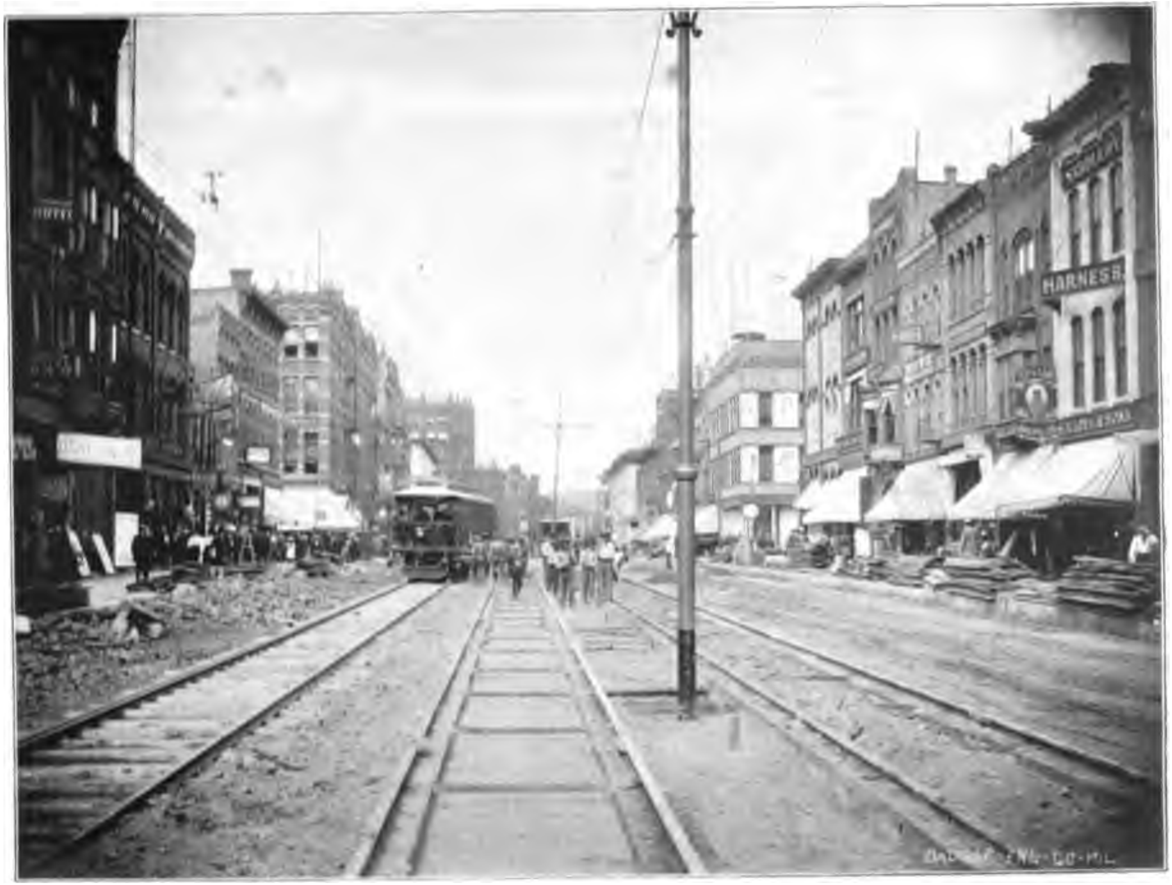

PLATE 7.

PLATE 8.

Cost of putting down temporary ties, and laying, lining, surfacing, joints, etc., of double track..	$ 1,700.00
Beam work, etc.	6,968.00
Rails and Tiebars	9,400.00
Asphalt paving at $2.43 per square yard, ten year guaranty	15,840.00
Total	$33,908.00 per mile

60-foot rails cost $2.00 a ton more than 30-foot rails.

This is a very heavy expense and it is sincerely hoped that the construction will prove satisfactory. About 2½ miles have been completed this season in Minneapolis.

As far as the writer knows the construction has only been used in Montreal, Toronto, and perhaps Detroit. In the two Canadian cities, the Castwelded joint was not used. The writer would suggest that a different "T" rail to be used, viz.: A rail 6" high with a 6" base. The 4½-inch granite blocks ought to be 5½ inches deep and 6" base would give a better bearing on the concrete beam.

It may be of interest to know that the Warren-Scharf Asphalt Paving Company claims a patent on the method of forming the asphaltic flange way before referred to. This Company did all the paving on streets with car tracks, and E. M. Ayers, using Utah lime rock asphalt, laid all streets without tracks.

Mr. A. D. Thompson, City Engineer, Peoria, Ill., then read the following paper on "Testing Paving Bricks":

TESTING PAVING BRICK.

BY A. D. THOMPSON, CITY ENGINEER, PEORIA, ILL.

The rapid increase in the use of brick for paving purposes has directed the attention of officials in charge of such work to the best methods of procuring the most durable material at a reasonable cost. Municipal officers agree that the three essential qualities to be possessed by paving brick are as follows: (1) It shall be tough, to prevent rapid wear, thus prohibiting brittleness or undue softness; (2) It shall be non-absorptive, to prevent disintegration by the weather and the absorption and retention of street fluids. which produce an unsanitary pavement; (3) It shall have sufficient strength to resist, without crushing or breaking, the heaviest loads passing over the street.

The old plan, universally employed, was to judge paving brick by inspection, and fully one-half the cities using brick pavements at present require brick satisfactory to the Engineer or Board of Public Works, without naming definite qualities. This is unfair to the manufacturers, as well as to citizens paying heavy assessments for street improvements, and is the main reason for condemning brick pavements.

Color is used by inspectors as the main guide to judge the quality, and it is a good basis to compare bricks from a single factory, after determining by tests the color indicating the best quality, but it cannot be used in comparing the qualities of bricks manufactured at different places. The various materials used,—clay, shale, fire clay, or mixtures of these,—the method of manufacture, and fuel used in burning,—coal, oil or wood,—all affect the appearance and color of a brick, and render it impossible to use the same color as a criterion by which to judge the bricks of different manufacture. The bricks manufactured at two places in this State are made from a shale which is supposed to be the same. The black bricks from one are the best, but the same color from the other factory indicates a brick that is unfit for use. Another factory used coal as a fuel for the first portion of the present season, and the black brick, while most acceptable under this condition, were rejected when the fuel was changed to oil.

Another strong point in favor of testing brick and inserting test requirements in the specifications is that by this means only is it possible to state the specific qualities which the material demanded must fulfill. Engineers draw up these specifications, as a rule, and the unprofessional method of requiring any material satisfactory to any man, or set of men, should be strongly condemned. It is acknowledged by engineers that the fairest competition and the best quality of materials can be be obtained for all construction work by making the requirements for same specific and definite. It is only by test requirements that the qualities of a paving brick can be accurately defined. Again, a continual demand for a better quality of brick, which reliable experiments indicate can be obtained, forces the manufacturer to supply the demand by raising the standard of his product.

The points which appear to establish the necessity of testing paving brick are:

1st. There is no other method of determining the quality.

2nd. It is the only method by which the qualities demanded can be definitely and specifically stated.

3rd. It is the only method of judging quality which is fair to both the manufacturer and citizens.

4th. The quality of the material is continually improved.

It is claimed by many engineers that the fitness of a brick for paving purposes can only be determined by submitting it to actual wear in the street, and that no system of testing has been devised which will determine whether a brick possesses the qualities ncessary for a good paving material. Even among the men who admit the necessity and appreciate the value of tests, there is a wide difference of opinion as to those which are necessary, and the methods of conducting same.

The amount of absorption in a specified time is used by some cities as the single criterion of the quality of a brick, while among the tests required by other municipalities are those for absorption, abrasion, impact, grinding, penetration by oil, transverse strength, crushing strength and chemical analysis. There are but three qualities to be determined, viz: toughness, non-absorptiveness and strength, and the three mechanical tests of abrasion, absorption and transverse strength show conclusively the degree in which these qualities are possessed by the specimen, thus making the additional tests superfluous. The chemical analysis of brick, and penetration by oil, give no data as to its wearing qualities, although the first test of the clay or shale is valuable in determining its fitness for the manufacture of brick. It is not necessary to determine the crushing strength, because a brick which possesses the requisite transverse strength is sufficiently strong to resist crushing.

The quantity of water absorbed in a given time indicates the probable disintegration by freezing, and is also an indication of the completeness of vitrification. Since the material is hard and dense, the brick should be immersed for a time sufficient to permit the water to reach the center of same, but this time should not be unnecessarily extended, as every day used in conducting tests may cause considerable loss to the contractor or manufacturer. There have not been sufficient experiments conducted to definitely establish the minimum time necessary for this test, the time usually specified varying from two hours to seven days. From experiments and observations in the past three years the writer has found that the paving brick absorb the larger part of water in 48 hours, after which the absorption is very slow, thus indicating that water reaches the center of the most dense brick in the first named time.

The bricks should be thoroughly dry before immersion, which condition can be attained by drying in a gas oven. They should also be broken, or the outer coating removed in some manner, as it is non-absorptive and seriously interferes with the absorption, in most cases. To determine the effect of the outside coating on ordinary paving brick, which were not salt-glazed, several lots were thoroughly dried and immersed in water, without breaking them or removing the coating. The amount of absorption in 48 hours was noted with the bricks in this condition. They were then broken in the middle and again immersed for the same period of time, with the following results:

	Per cent. Before Breaking.	Absorption. After Breaking.	Average Gain, Per cent.
Lot No. 1, average of 27 samples....	1.49	3.72	2.23
Lot No. 2, average of 14 samples....	5.84	6.05	0.21
Lot No. 3, average of 20 samples....	1.38	1.70	0.32
Lot No. 4, average of 7 samples....	3.32	3.33	0.01
Lot No. 5, average of 11 samples....	4.59	4.67	0.08
Lot No. 6, average of 4 samples....	5.67	6.01	0.34
Lot No. 7, average of 13 samples....	3.59	3.88	0.29
Lot No. 8, average of 12 samples....	5.11	5.31	0.20

Each lot of brick was obtained from different factory.

This coating is the most impervious on the very hard-burned brick, but as the interior of these is generally non-absorptive, the effect of the coating is most noticeable on the medium-burned, with a hard coating and a softer interior, there being practically no coating on the very soft ones.

The amount of absorption allowable depends largely upon the material from which the brick is manufactured. In the winter of 1894-5 the writer conducted some experiments to determine this point, using bricks in each lot of varying degrees of hardness, from those which absorbed nothing to bricks which absorbed 10 and 12 per cent. in 48 hours. Lots were procured from two factories producing shale brick. After immersion in water for 48 hours they were placed in a brewery brine tank until thoroughly frozen. They were then thawed, dried and weighed, and this process repeated fourteen times. The tests were stopped at this point by an inquisitive genius, who obtained access to the laboratory and broke large pieces from all the bricks in sight, to examine the interior. These experiments, however, indicated that with shale brick an absorption of from 5 to 6 per cent. in 48 hours could be allowed, with no resulting harmful effects from the frost, and considering the absorption test merely as an indication of the action of the frost, the requirements of the different municipalities are generally too severe. This conclusion was corroborated the next winter, when the same experiments were conducted upon lots from seven factories. In this case the bricks were immersed in a shallow pan of water and frozen five times by exposing same to the weather.

But this test is of more value as an indication of the vitrification or the point just previous thereto, which is an absolute requirement for good paving brick. This quality is shown by no other test thus far devised, and a brick which absorbs more than 2 to 2½ per cent. of water in 48 hours lacks this element to such an extent that it will not produce the best results in a pavement.

The transverse test gives the strength of the brick when used as a beam, with the load applied at the middle, and is valuable in determining brittleness and showing laminations. A high transverse strength is also an assurance of high crushing strength. For these reasons this test is of more value than is generally accorded it. It is made by supporting the bricks at the ends upon knife edges and breaking same by pressure applied by knife edge at the middle, with bricks laid flat. The strength per square inch of section is then figured by the beam formula—$R=(3^1\div 2bd^2)$ w, where R=modulus of rupture per square inch, 1=length in inches between supports, b=breadths in inches, d=depth in inches, and w=loads in pounds. The highest modulus required three years since was 1,600 pounds, but this requirement has steadily increased until the past season the writer has required a modulus of 2,200 pounds, and has obtained extremes of 5,800 and 6,000 pounds, while moduli of 3,800 and 4,000 pounds have not been uncommon. These results were obtained without grinding the surfaces to parallel planes, or placing on them anything to equalize the pressure.

The toughness is generally determined by the abrasion test, which generally consists in tumbling a number of bricks in a foundry rattler for a certain length of time, together with given quantities of scrap iron, or other substances of various sizes and weights. This treatment is intended to produce the same effect upon a brick as the blows of horses' shoes, which is the main cause of wearing on brick pavements, and it is preferred to the grinding test, because it is less difficult to conduct and more nearly represents the actual wear on the street. A test conducted in this manner is the best that has been devised for such a purpose, but is is far from satisfactory, because of the uncertainties attending the results obtained at different places. The size, shape and speed of the rattler, the size, quantity, kind and weight of the scrap iron or other material used, and the number of bricks tested at one time, are all factors determining the toughness of a brick, which vary with every engineer. The rattler should be of sufficient size to tumble the bricks and allow a reasonable fall of same. Experiments conducted by Prof. A. N. Talbot, at the University of Illinois, and Mr. H. J. Burt, to determine the effect of size of rattler upon the abrasion test, tend to show that, "for lengths sufficient to prevent the wedging of bricks at the end, say 20 inches, there is no great variation in results, the relative number of brick and proportion of volume of rattler filled remaining the same" Also that "a rattler 24″ in diameter gives greater wear than one of small dimensions, and that there is probaly little difference between one 24″ and one 30″ in diameter."

Prof. Orton, of the Ohio State University, in reporting the results of tests to the National Brick Manufacturers' Association, conducted to determine the effect of length and diameter of rattler, says, "the length of the cylinder was varied from 12 inches up to 48 inches by the use of my movable diaphragm. The shortest cylinder, 12x28, say, gave less regular results than those which were longer, because of the tendency of the brick to wedge endwise. But from 18 inches up to 48 inches in length (the diameter being always constant), the wear was substantially uniform for all sizes, showing that if the percentage of volume of the charge and the time and the speed being maintained equal, that length cuts no figure." As the result of his experiments to determine the diameter producing the greatest abrasion, Prof. Orton concluded that all other conditions remaining uniform, the loss varies directly as the diameter up to a certain point, and that above a diameter of twenty-eight inches, there is no increase in rate of loss.

The abrasion is also affected by the shape of the rattler, which is generally circular or hexagonal. The interior of the circular iron rattler is soon worn so smooth that, instead of tumbling, the bricks merely slide around, and it is best to fasten three or four narrow wrought iron strips on the inside to prevent such action. The abrasion is less in wooden rattlers than in cast iron, because the wood acts as a cushion in breaking the fall of the brick.

The amount of abrasion with a given number of revolutions depends to a great extent upon the rapidity of the same. If the rattler be revolved at a very high or very low speed, the effect produced upon the samples is slight.

Experiments conducted by the writer, and corroborated by results obtained by Prof. Talbot, indicate that the maximum loss appears to be obtained at a speed between 20 and 30 revolutions per minute.

Scrap iron is generally used for the abrading material, because of its cheapness, but the size, kind and quantity to be placed in the rattler varies widely. The size should be such that not only a grinding effect is produced, but the bricks should receive blows at each revolution which will be similar to the blows received in the pavement. Many engineers advocate using foundry shot or stars, which produce a grinding effect only, but the main objection to the use of small pieces alone is that the brittleness of a brick is not discovered. The abrasion test, using foundry shot for the abrading material, is no measure of the toughness, as brittle bricks under such conditions give the highest results, unless this fault is shown by the pounding of the other samples. Brittleness is the most serious fault of paving brick to-day, and it must be overcome before brick can compete with other paving materials for streets of heavy traffic.

The grinding and pounding effect can both be obtained by using scrap iron of various weights, say from one-fourth of a pound to five pounds, with a certain per cent. of pieces of intermediate weight. Pieces larger than about five pounds in weight break many of the bricks. In order to make the tests uniform, the scrap iron should be revolved until the sharp edges are worn off, and the same point observed as new iron is added. The quantity of scrap iron that should be used and the number of brick tested at one time depend upon the size of the rattler. There should be sufficient scrap iron to fill the rattler the full length for a depth equal to about one-sixth its diameter.

The size of the rattler and quantity of abrading material used determine the number of bricks it is best to test at one time. A sufficient number should be placed in the rattler to eliminate accidental loss, as nearly as possible, but it must be borne in mind that too great a number will cause a large breakage of the samples. With a rattler two feet in diameter and three feet long, with 300 pounds of scrap iron, the writer has found 12 bricks a good number. The number it is safe to use can readily be determined in each case by a few experiments, maintaining the same conditions and noting the effect of varying number of samples.

The experiments conducted by Mr. H. J. Burt and Prof. Talbot, previously referred to, give some interesting data regarding the size and amount of scrap iron producing the greatest abrasion. Regarding these tests, Prof. Talbot, in a personal letter, says:

"The tests were made with shot of two different sizes, the larger size 2½"x3⅛"x5¼", with corners rounded with ½" radius and weighing about 8 pounds each, and the smaller size 1"x1½"x2½", with rounded corners, weighing about one pound each. In some of the experiments ordinary foundry shot was also used. With one pound of shot charges of 100 pounds to 400 pounds gave nearly equal losses, while 200 pounds gave a greater loss. With eight-pound shot, the larger the charge the greater the loss, 400 pounds being the greatest amount used. With a mixture of 100 pounds of one-pound and 200 pounds of eight-pound shot, the loss was 40 per cent. greater than with 200 pounds of one-pound and 100 pounds of eight-pound shot. The action in the two cases is quite different. With eight-pound shot there is considerable spalling and chipping, while with the one-pound shot the abrasive action was the principal one."

"The use of the brick alone, without foundry shot, which has been recommended by some experimenters, was not considered desirable, because the loss varied so much with charges composed of different numbers of the same kind of brick, and the size of the brick also had an unknown effect, and likewise there was some chance of accidental and unusual loss to individual brick. To avoid these, it seemed to me necessary to use as many 24 brick, a very cumbersome test."

This test should be conducted a sufficient time to produce an appreciable loss and develop the faults of the bricks. The duration of the test should be governed by the amount of iron used in the rattler, and the number of revolutions per minute. During the season of 1894 the following tests were made by the writer, to determine the limit of time for the abrasion test. Bricks of different manufacturers were obtained, and each lot was revolved for four consecutive hours, the loss being noted at the end of each hour, and expressed in terms of the weight at the beginning of each hour, all conditions of the test remaining the same for each lot. The following results were obtained, which are the averages:

	Per cent. loss.				
Lot.	1st Hour.	2nd Hour.	3rd Hour.	4th Hour.	Total.
1...........	8.35	6.79	5.47	3.99	21.4
2...........	11.44	6.81	3.55	3.04	22.3
3...........	11.07	5.09	4.40	3.43	22.5
4...........	9.28	5.09.	3.31	2.11	18.2
5...........	12.59	6.67	6.21	4.12	26.4
6...........	9.40	4.00	4.08	3.61	19.7
7...........	9.45	4.52	4.59	3.14	20.0
8...........	7.92	4.74	3.59	2.24	17.4
9...........	6.59	2.32	2.54	2.00	12.9
10...........	11.16	5.55	4.00	2.97	21.8
11...........	7.11	4.07	3.79	2.58	16.75
12...........	7.99	4.81	3.17	2.64	17.62
13...........	6.52	4.07	4.66	4.33	18.29

These experiments showed that, under the conditions imposed, one hour produced an appreciable loss upon the best paving bricks, and that the loss gradually decreased. For this reason one hour was adopted as the limit for the abrasion test. The conditions under which the tests were conducted are as follows:

Circular cast iron rattler two feet in diameter, three feet long, and containing 200 pounds of scrap iron, weighing from one-fourth of a pound to five pounds. The rattler was revolved at the rate of 15 revolutions per minute for one hour; shaft does not extend through rattler; not more than 12 bricks 2½x4x8 inches in size being tested at one time.

The abrasion test has since been conducted in the same manner, except that during last season four wrought iron strips one inch by one-half inch, equally spaced, were bolted to the inside of rattler to prevent sliding, and the amount of each size of scrap iron has been used in the following proportions:

Fifty pounds of each of the following weights:

¼ lb. to ½ lb.
½ " " 1 "
1 " " 2 "
2 " " 3 "
3 " " 4 "
4 " " 5 "

The custom of comparing the loss by abrasion with the loss of some other substance subjected to the same treatment gives unreliable results. The substances generally chosen are cast iron or granite, of the same size as the bricks. The comparison with Quincy granite, as proposed by Prof. Baker, of the University of Illinois, appears to be especially faulty.

In the first abrasion tests conducted, the writer attempted to compare the loss of the bricks with that of Quincy granite cubes subjected to the same treatment. For this purpose granite cubes were procured from Vermont, and were received with rough edges. No marble yard in the City could dress them, and the experiments were conducted with the cubes in that condition. These experiments soon developed the fact that the cubes varied in hardness, and the loss of the lot was not regular, being much less after the rough edges were worn off. The plan was then adopted of obtaining the loss in per cent. of the original weight, and this method has been perfectly satisfactory.

The lack of uniformity in the requirements by different municipalities of the kind of tests, manner of conducting same, and results desired, has caused much dissatisfaction among engineers and manufacturers, and has made brick tests of no value except for local comparative purposes. Engineers, municipal officers, manufacturers and citizens will not place confidence in such results until a standard of the tests required and manner of conducting same is adopted by the several cities interested.

The Chairman: This finishes the reading of the papers of this group. It may be well to mention that wherever exhibits are referred to in any of these papers, that the same will be embodied in the printed report hereafter to be issued, and distributed to the members of the Society.

There is still another paper here on this same subject by Mr. Ballard of Syracuse.

Mr. Ballard then read the following report:

Syracuse, N. Y., Sept. 12, 1896.

A. D. Thompson, Esq., Chairman Committee on Street Paving:

Dear Sir: I am in receipt of your favor of July 17 and August 22 last, and note the request made therein by yourself as Chairman of the Committee on Street Paving, which was appointed by the American Socity of Municipal Improvements, at its meeting held in Cincinnati in 1895.

From our limited experience in this City with the matter of street paving, I do not think a paper could be prepared that would add much to the information of the Society on that subject, therefore I will leave that to older cities, and simply give a short statement of our experience with the various paving materials which we have tried.

Our City has tried during the last thirty years the following materials for paving, viz.: Macadam, Cobble, Nicholson, Greeley, Sandstone Brick, Sheet Asphalt, and Sheet Asphaltina. This last mentioned is a manufactured material of which more will be said later on.

The Macadam, Cobble, Nicholson and Greeley pavements have proved very unsatisfactory, and none of them have been laid for a number of years. The main objection to them was the frequent repairs required to keep them in proper shape.

We have some sandstone laid, and while, before the advent of smooth sheet pavements, sandstone was very much in favor, at present none is being used, as our property owners no longer petition for stone, preferring to have smooth surfaced streets.

Brick has been given trial on about 3½ miles of streets, but during the past three years no additional contracts have been made.

Brick was preferred for a time as it was much cheaper than asphalt, the asphalt offered being confined to one kind only, viz.: Trinidad.

Something less than two years ago the introduction of California asphalt led to a very much lower price being named by all the paving companies, which price was also less than the actual cost of brick, so that our people no longer asked for brick pavements. Our experience with brick has been very unsatisfactory, our citizens constantly complaining about the constant chipping off of the edges of the brick, the noise of traffic and the dirty condition of the street which exists at all times, although frequent cleaning is done with the most modern street cleaning apparatus.

Bermudez asphalt has been laid upon one street only, but as it was completed about one month since we can form no opinion as to its desirability as a paving material.

California asphalt is to be laid on four of our streets, but will not be commenced until next year.

The only asphalt which has had a few years' wear with us is Trinidad, both the "land" and "Pitch lake" having been used. No difference in the wear of either is perceptible.

Our asphalt pavements, while being nearer the ideal pavement than any other yet tried, are not wholly satisfactory. They do not wear well when laid along street railway tracks, although separated from the tracks by the use of a stone stretcher four inches in width. The cause of complaint is the actual decay of the paving material, and to such an extent that the street railway companies have requested permission from our city authorities to repair the strip between and outside their tracks with any material other than asphalt. These repairs are at the expense of the street railway companies, and in our city the item has been no small one. On some streets the companies have been allowed to substitute brick, although against the wishes of the owners of the property abutting upon the street.

Frost seems to cut quite a figure in our asphalt pavements, many of them being very badly cracked, requiring quite extensive annual repairs.

What seems to be lacking is a satisfactory system of testing asphalt paving material for tensile strength, elasticity, density, etc. Tests should be established by competent engineering authorities, and made a part of all specifications. While some of our asphalt pavements are very hard, those on other streets will be much softer, and the result is the hard ones crack in freezing weather and the soft ones will in a larger or smaller degree show indentations, which after a time crumble away, and the repair of that particular street is next in order.

We are also trying the new paving material called "asphaltina," mentioned in the earlier portion of our letter.

Asphaltina is a compound material, manufactured by the Asphaltina Company of America, who have their main office in Syracuse. The material has been used in street traffic about two years, both in our city and elsewhere, and so far bids fair to do good service.

It is laid in continuous sheet form the same as asphalt. Tests made in the presence of the writer, both of asphaltina and of asphalt for tensile strength, showed considerable more than double strength in favor of the former.

It is claimed for asphaltina that, even though flooded with water, it will not decay, and also that the frost will not cause cracks to appear. It is also laid without using gutter stones, which results in reducing the cost. This material being impervious to water, would admit of the pavement being cleaned in the manner in use in the city of Paris. There the hydrants are opened each night, and the rush of water rapidly and thoroughly removes all undesirable matter. Our asphalt pavements are not allowed to be sprinkled even, except just prior to sweeping and then only to a limited extent.

One side of one of our busiest streets was paved for one block with the asphaltina about fourteen months ago, and while the traffic it sustains has been severe, the pavement shows no evidence of wear, and judging from its appearance bids fair to outlast anything in the pavement line that we are now using.

The cost of asphaltina is a little less than we have been paying for asphalt, since the introduction of the California product. The asphaltina company was awarded recently the largest contract we have made this year for street paving, being on Mulberry street, one and one half miles in length.

With best wishes for the success of the annual meeting of the Society this year, I remain,

Very respectfully yours,

ROBERT BALLARD.

The Chairman: A motion has been made to adjourn. I was going to say if there are any delegates now present who desire to ask any question regarding any of these papers, they can now do so, that we may finish the paving question at this evenings's session.

A Member: If you keep on you will run into the evening session.

Mr. Stainsby: Would it not be better to have at some future time a discussion of the question of brick pavements. I know there are quite a number of gentlemen here who have had experience, and there has been no chance for an interchange of ideas. It seems to me if we could have a time set apart for it, it would be very desirable.

Mr. Benzenberg: It seems to me it would be better to take up the discussion of the subject now. It is 5 o'clock and we can not expect by adjourning at 5 o'clock to complete the work of this convention within the time limit. It occurs to me it would be better to take up the discussion of these papers and complete it as far as possible until it is time to adjourn for dinner, and be ready if possible to take up the subject on the programme for 8 o'clock.

The Chairman: The motion to adjourn has been withdrawn. If there are any delegates present who desire to ask any questions pertaining to any of these papers, they may now do so.

Mr. Eldredge, La Fayette, Ind.: I want to ask the gentleman from Marietta, who has been using beveled brick in preference to standard, whether they have used both kinds and found it better to do so. With us we have used both kinds, and we have found that the rounded edge bricks scaled off to about the same extent as the square edge, and I wanted to know if your experience was with both kinds.

Mr. Hathaway, of Marietta: We have several miles of both kinds. The first that we laid were the standard brick with a sharp edge, common brick, I suppose you would call them, only a little larger, and the edge of those now, after three years' wearing, are very ragged. The next year we laid a re-pressed block, which is considerably larger than the other. These were laid on a street near the Union Depot, where we have the heaviest traffic, and so far you can hardly see any effect from the wear on this block. Of course once in a while there is a soft brick that escaped the inspectors when the pavement was laid, but those that were of good quality when they went in are still standing without hardly an abrasion. That is our experience.

Mr. Van Duyne, of Newark: I would like to ask whether that brick was laid with a cement grout, or whether the interstices were filled with cement?

Mr. Hathaway: No sir. The excavation was filled back with six inches of gravel and a top dressing of two inches of sand, in which the brick were laid. A slight coating of sand was then spread on top of the brick and broomed in, and then the brick were rolled with a seven-ton road roller. After that an inch of sand was spread over the top, which formed a sand filler between the brick.

MR. VAN DUYNE: Perhaps Newark seems too much interested in the paving problem, but we have spent last year about $800,000 in paving, and this year about $700,000, and in trying the brick pavement as an experiment last year, we laid it as we thought in the best possible way and filled the joints with cement grout. I have no doubt but that makes the most durable brick pavement when laid, but it is unsatisfactory on account of the loud rumbling noise to citizens living on the line of the street, so that we are rather discouraged as to putting down any more brick pavement. That is our experience.

MR. JEUP, Indianapolis: Our experience in brick paving in Indianapolis has been with both standard sized brick and also with small sized brick. The brick pavements are laid on concrete pavements. The standard sized brick and also the compressed small sized brick has been discarded. We now use only the block with cement filling and also with Portland cement filling and asphaltic cement. The asphaltic cement filling has found greater favor in the city than anything else on account of the lessening of the noise. The brick pavements have not found very much favor in the city on account of the noise on the residence streets.

There is one question, however, that I would like to have an opinion on, and that is, the method of laying brick. We have been in the habit of laying brick at right angles to the curb. We found that the intersections which are laid diagonally do not wear as much in wood block streets and also in brick streets as those laid at right angles to the curb. We have taken steps to lay blocks diagonally at an angle of 45 degrees with the curb and find that it lessons the wear at the joints. I would like to have some expressions on that method of laying brick.

MR. SHERRERD, Newark: I had some experience in that line myself with fire clay bricks. We found that the horse's toe corks took off the corners of the bricks when laid at an angle of 45 degrees. I think the gentleman who just preceded me, spoke about the joints wearing down, in our case it seemed more destructive on account of the whole corner going off.

I would like to speak on Mr. Thompson's paper. I have had almost the same experience that he has had. I agree with him that it is quite essential that some standard should be adopted and should be maintained in making tests of paving bricks. In Newark we established a certain rattler test by first trying several kinds of standard bricks and noting the results obtained with them, and then using the same rattler in all future tests.

MR. HATHAWAY: I would like to ask Mr. Van Duyne in regard to the noise complained of in Newark, where they have pavements laid both with and without the cement grout, whether there has been any comparison between the noise of brick simply laid in the sand and gravel, and those laid in grout.

MR. VAN DUYNE: We are laying a very short trench with the sand filling, but the trouble that we feared was that with the sand filling the paving would not be as durable as when filled with the cement grout.

MR. KEATING, Toronto: I should like to ask Mr. Van Duyne if the bricks are laid as close together as they can be placed?

MR. VAN DUYNE: Yes, we put them close together.

MR. KEATING: I would like to say with reference to Mr. Cappelen's excellent paper, that in Toronto we have constructed the railway tracks on two or three streets in somewhat the same manner as he had described, that is, with iron tie bars, the tracks being laid on a continuous concrete base or bottom for the rail, omitting all wooden ties or sleepers, with the very best results. I refer to the unsatisfactory condition of the asphalt pavements between the track lines throughout the city generally; I should have perhaps excepted those streets where iron tie bars have been used and the asphalt has been laid between the rails in the manner described by Mr. Cappelen. These streets, however, have only been laid about two or three years, so that further experience with them would seem to be desirable.

I would like to ask Mr. Thompson if I am correct in what I gather from his paper, that he considers a brick which showed an absorption of 4 to 5 per cent. a better brick than one that had an absorption of only two per cent.

Mr. Thompson: I do not understand.

Mr. Keating: With reference to the absorption test of the bricks, do I understand that you are of the opinion that the absorption of four to five per cent. was quite good enough and better in fact than if the absorption was less?

Mr. Thompson: My statement was that a shale paving brick which absorbed from four to five per cent. of water in 48 hours could be used in this climate and show no material effect from the frost. Such a brick would be less brittle than one which absorbed one and one-half to two per cent. in the same period, but it would also wear away more rapidly.

Mr. Keating: Then you would not object to a brick that would absorb four to five per cent?

Mr. Thompson: I would not use a brick which absorbed so much water, because it is not vitrified sufficiently to be tough.

Mr. Keating: With reference to Mr. Ballard's paper, where he refers to gutter stone, I do not think that is so on asphalt streets. I do not know whether it is new to the Association, most likely they have tried the same thing in other cities, but in Toronto we have lately been doing away with gutter stones altogether, and not laying the asphalt up to the curb, but substituting a concrete or granalithic gutter way instead of stone, with very excellent results, and it makes a very much neater street. I should like to have heard from Mr. Ballard with reference to the "asphaltina" he described, if he knows what the composition of that is. We have put down a small experimental piece in Toronto which has so far answered very well; it has been down a little less than two years. It stood the first winter very well indeed, but in hot summer weather it got rather soft, showing the cork marks of the horse's hoofs. Those marks were all gone recently, I fancy they will return again next summer with hot weather and perhaps they are not very detrimental, but it would be satisfactory to know what the composition of the material is if he could tell us.

MR. ADAM, Newark: I would like to ask Mr. Thompson whether he would allow a difference in absorption between fire-clay and shale brick. Why wouldn't it be fair and just to allow a larger percentage for the fire-clay than for the shale brick? Also whether both shale and fire-clay brick are in use in the city of Peoria, and what the merits are of the respective bricks as to their wearing capacity or showing the effects of travel?

MR. THOMPSON: In answer to Mr. Adam, I would say that I have not conducted enough tests on fire-clay paving brick to determine the amount of absorption which is allowable. I have made enough tests with fire-clay brick, however, to indicate that a brick of this material is not so tough as a shale brick which absorbs the same amount of water in a given period.

MR. ADAM: I would also ask the question whether they have any fire-clay and shale brick pavements in Peoria, and what their comparative merits are as to other pavements?

MR. THOMPSON: We have no pavements composed of pure fire-clay brick. Several blocks are paved with a brick from mixture of fire-clay and shale, which have shown a high degree of toughness and given good satisfaction.

MR. W. H. KNOWLTON, Dubuque, Ia.: I would like to state briefly our experience in brick pavement for the past five years. The question came up as to the standard size of brick. Our experience shows that what we call the standard brick, about the size of the usual brick, round corners, have proved more satisfactory, although we have used the square cornered brick also.

There is another question in reference to foundation that I would like to hear if any other member of the Association has had a similar experience. We have about seventy miles of macadamized streets, and when we put down brick pavements of course this is removed and the street graded to the proper lines. First we used the standard concrete foundation, mentioned at this convention. Other streets are improved in this manner. First the street is graded down to the proper lines, then we put what is called a Telford pavement, breaking the rock on the street, then a seventeen-ton steam roller is put on the street and the street rolled thoroughly, and wherever any depressions appeared, they are filled in with fine rock and the roller used again until it was brought to the proper lines. The work is kept wet while the roller is being used. I call this foundation, to distinguish it from concrete, macadam grout. We then take and mix cement and sand in the proportion of one to one, and make grout and pour it onto the street until all the interstices are perfectly filled and it is perfectly water-tight. On this foundation from one to two inches of sand is placed and the brick placed on the sand in the usual form. We use the sand filler, with one exception, when Portland cement is used. The Portland Cement filler in some cases is not as satisfactory as sand. We have had these streets down about a year, and while some of the streets were improved the same year with regular standard concrete foundations, my experience shows that the macadam grout gives us much the smoothest street. I am curious to know whether any one else has had the same experience. I imagine a good many will say that this is no foundation at all, but our brick maintains a much smoother surface and it has this advantage, the street can be improved in much less time. For instance, you get the street graded and if you have a sand and gravel foundation you cannot use a steam roller, while, with this six inches of broken stone on the surface, you can put your steam roller on and roll and sprinkle at the same time until your street is very solid and hard, then you can put your brick on immediately and have your street open to travel in much less time than you can with concrete foundation and the price is less. We can get it done for thirty cents a square yard less than we can concrete, and in every instance where we have used it it has proved to be better. Of course, we have only had the streets in use something over a year. I would like to know if any one else has used a similar foundation. It is not unlike Mr. Hathaway's except that we make use of the broken stone and the gravel. I think that the broken stone will be superior to the gravel.

MR. CAPPELEN, Minneapolis: I would like to know what the price of the concrete and the price of the macadam grout per square yard are?

MR. KNOWLTON: The first street improvement a few years ago, none of our local contractors had had experience in putting down brick pavements, consequently they did not bid understandingly, and an outside contractor came in and did the work. The price on that work was $1.69 per square yard for taking out the old street, putting down the concrete foundation and furnishing the brick and the sand, without any curb. There was a car track in this street, however, which increased the price a little per square yard. The cost of the macadam grout foundation last year was $1.08 per square yard, the price last year with the regular concrete foundation was $1.35 a square yard.

MR. V. LEASLEY, Youngstown: I would like to ask what is the cost of brick per thousand in the various cities, as it enters largely into the make-up of a street.

MR. CAPPELEN: Minneapolis paid $15 a thousand for repressed Iowa, Des Moines and Galesburg brick. Streator brick, of Streator, Ill., sold at $13, but the three companies that I mentioned formed a pool last year, and got the price up to $17, this is delivered on the cars Minneapolis. That makes the brick price a little high, too much freight, we have to pay about $7 a thousand freight.

MR. KNOWLTON: I will say in Dubuque, Ia., the brick costs from $9.75 to $10.75 per thousand.

MR. PEARSON, Louisville: I would like to ask the gentlemen who have been using cement grout for filling in the brick after the bricks have been laid, what the proportion of cement is they use, also what kind of cement, I would also like to know what the adhesion is. My reason for asking this question is that only two weeks ago I had an alley laid with Star blocks, that were highly glazed, at least they were very considerably vitrified on the outside. I had a grout box made and I used one proportion of Louisville cement, very fresh, and one proportion of very fine sand, I kept the men employed all the time in mixing, so as not to give the grout any opportunity to set in the box. We then poured the grout into the spaces and let it set for two or three days. I found that the grout got hard enough, but there was no adhesion whatever between the grout and the brick. I want to understand what the proportions are and what kind of cement they are using.

MR. ADAM: We did some brick paving last year with cement and sand. The specifications called for a special box to be placed on wheels, in which to mix the grout which was to be continually stirred while being drawn over the pavement. But that was a theoretical way of doing it, and the practical way was that the men had a box in which they stirred the grout and then discharged the contents upon the street. This year we paved another street with cement grout when the contractor simply took a tub and mixed up the cement grout, and when it was properly mixed he upset the tub and disposed of the whole contents on the pavement. I thought that was the most practical way of the two methods. I had sent me a sample of salt-glazed brick, but I wrote the manufacturer that the Board did not intend to use salt-glazed brick; I was afraid if we did use them the cement grout would not properly adhere to the surface of the brick.

MR. HATHAWAY: I think it ought to be stated further in regard to the two kinds of brick, those that are beveled, or repressed and the common brick, it is the experience in Marietta that the wheels make less noise on the common brick than they do on those that are beveled, and that is one reason why there is a feeling among the citizens that we would rather have common brick, besides that they are always a little cheaper than the other, the re-pressed having passed through the machine twice, and therefore cost more money, and the breaking of the edges is not such a serious difficulty after all, as it seems to be.

MR. LEASLEY: I would like to give our experience with reference to hydraulic cement filling. We have one street that was put down two years ago with hydraulic cement filler in proportion of one to one; it is very essential that the brick should be well sprinkled previous to putting on the cement. That possibly accounts for the cement and the brick not adhering in the case spoken of just now. We find there that where it is properly brushed into the brick that it takes thorough bond and it is as solid as rock, and in taking up the streets we find that the brick has to be torn to pieces, the bricks are useless, comparatively, for repaving the street, because they are so thoroughly adhered that the cement holds and the brick breaks rather than parting at the seams.

THE CHAIRMAN: I want to suggest that the papers that are on for this evening touch on the subject of bonding pavements, and the rumbling of brick pavements, probably some of the points that you are now trying to cover will be covered this evening.

MR. FARQUAR, Zanesville, O.: I would like to ask of the gentleman from Marietta, if they use the same foundation under the ties where the tracks run over paved streets, as they do under ordinary brick. Our great trouble on streets where we have the railroad to contend with, is that the ends of the ties disturb the brick. We use six inches of gravel and two inches of sand, and we find the foundation very satisfactory, but we do have trouble with the ends of the ties forcing the brick out.

MR. HATHAWAY: I will answer that in this way, that we compelled the Street Railroad company to put their ties down eight inches and then put on an eight inch stringer, thus getting the ties down so far that they did not touch the brick in any way whatever, and the new street railroad, the electric line that is going in now, are putting in pounded stone under the ties, and a six inch T rail on the ties, so that will put the ties down so far that they will not interfere with the brick.

Mr. Lewis, Brooklyn: This paper of Mr. Cappelen's on the subject of street railroad construction has hardly been touched upon. It seems to me that he has introduced one of the most important matters that we have to deal with, especially in the larger cities where the question of pavement in connection with the railroad tracks is repaving rather than original paving. I must confess that it seems to me that the present relations existing between municipal governments and the railway and other corporations having rights and franchises in the public streets can be characterized not only as municipal folly, but almost as municipal crime. They seem to have gotten beyond the control entirely of the city authorities. There seems to be no acknowledgment on their part of their own responsibility, as to the condition of the pavement. They are evading it constantly, wherever possible, and our city officials cannot seem to bring them to terms. I think the work done in Cincinnati, which city is probably the pioneer in proper track construction, has been invaluable. They have laid there some forty odd miles of street railroad tracks with a cement concrete foundation under the ties, carrying the concrete up to the bottom of the pavement, whether granite or asphalt. I believe that the work done by Mr. Keating in Toronto and that described by Mr. Cappelen is still better. I hope it will prove to be better, though it is somewhat experimental as yet, but the railway companies have got to understand that they must put the most durable foundation that it is possible to lay, no matter what the expense. The question of renewal of pavements on railroad streets is also a very knotty one. Under the charter of the City of Brooklyn it is prescribed that in case the city repaves any street there shall be contributed by the railroad company occupying it such a proportion of the expense as shall seem proper to the commissioner of city works. That means anything or nothing. It meant nothing for a great many years. We have now a local improvement law of two years standing, which provides that in repaving one fourth of the entire expense is assessed upon the street railway company occupying the street, one fourth only upon the property, while the city pays one half. That is in repaving where the original improvement was made at the entire expense of the property holders. What we want is that when these tracks are reconstructed it must be done in a better manner than it has been in the past. The question of the form of rail to be used is a very difficult one. The general Railroad Act in the State of New York provides that no more center bearing rails shall be used, but such type of rail as may be acceptable to the city officer having the matter in charge. I succeeded this year in having our commissioner authorize me to inform the city railway companies that no more permits would be given for laying the Johnson girder rail with broad flange such as is now in common use, but that a grooved rail must be used. One of the railroad companies is opposing it vigorously, claiming that on account of the filling of the groove, it will be impossible to stop the cars, thereby making it dangerous. Of course that is all nonsense, for we know that in Cincinnati, Washington, Toronto and Buffalo, they have the grooved rails and there is no trouble from this source. But what I also want to try and enforce is that in all reconstruction the roadbed shall be placed upon concrete and if the cross ties can be eliminated so much the better. We will all watch with a great deal of interest the result of the work in Toronto and Minneapolis. I believe that we, composing this association, should use our utmost endeavor to try and solve this problem and force the railroad companies into proper methods of track construction. If it can be accomplished in two or three cities, they will accept the inevitable, and I am confident it will be to their advantage. To remove perishable wood from the street bed is certainly a step in the right direction, and with the rails resting upon concrete stringers or beams, and imbedded in concrete, we will have taken a long step in advance and helped to solve this vexed problem of the proper control of the railroad corporations.

One other thing about corporations I may mention. We have recently decided in the city of Brooklyn to issue no permits to any railroad, gas, electric or other company occupying the streets, except on condition that if any asphalt pavement, whether laid over a stone pavement or on concrete thick or thin, or any brick or granite pavement laid in concrete be disturbed, it shall be repaired with eight inches of Portland cement, concrete foundation. Our endeavor is to make this work just as expensive as possible, thus discouraging the opening of the streets except in cases of absolute necessity. I suppose we cannot yet hope to have the city control or own absolutely all subways, pipes or constructions of any kind in the streets and derive a substantial revenue from their rental. I think that is what we will eventually come to, but if we talk of it now we will be accused of disloyalty to our American traditions, copying European methods and so on, and that won't do of course, although we must admit that we are way behind the cities of Europe in our management of these affairs.

On motion the meeting adjourned until 8 o'clock P. M.

Wednesday, Oct. 14, 1896. Evening.

THE PRESIDENT: I wish to state that the chairman of the Committee on Street Paving has informed me that before the proceedings are printed the committee will get up a schedule of prices paid for street pavement during the past year, as that seemed to be the subject of considerable inquiry amongst the members, we thought it would be interesting to have it included in the proceedings, and I told him I knew that the members would heartily appreciate that part of the work on behalf of the committee.

The discussion on the papers read this afternoon was not completed, and as I know that there are several here who are able to give us a little more light on the subject of testing paving brick, I will take the liberty of calling upon them. Mr. Holman, of St. Louis, I think can give us a little additional light upon that, and I will call upon him to say something of this.

MR. HOLMAN, St. Louis: About a year ago it fell to my lot to put in shape a laboratory for testing building material. One of the problems put before this laboratory was the testing of vitrified paving brick to develop, if possible, a standard specification. The first part of the work undertaken was the examination into the question of the absorption of water, and I will state as briefly as possible some of the results, without going very much into technical details. We find that vitrified paving brick absorbs water rather rapidly at first, and slower as the time goes on. We extended the experiments up to six months and the brick were still absorbing water very slowly. We found that about forty-eight hours would give a fair indication of the rate at which the brick was going to take water; that is to say, each manufacture of brick has a characteristic absorption curve. If you plot the time along the axis of abscisae and the amount of water absorbed along the axis of ordinates, you get a characteristic curve for the absorption of brick. We found that this characteristic curve was an indication of the burning of the brick, but gave no comparison between the brick of different manufactures. We further found that the absorption curve had no relation to the other physical properties of the brick.

The second matter taken up was the question of the toughness, or the ability of brick to withstand the abrasion. The investigation on that line was with the ordinary foundry tumbling barrel. We found there also that each special line of brick had its characteristic curve. You plot along the axis of abscissae, the time, and along the axis of ordinates the percentage in loss of weight, and you develop for any particular manufacture of brick a characteristic curve. We find that about forty minutes time gives a good point on that curve. As to the tumbling of the brick, we use the ordinary foundry barrel, about twenty-six inches in diameter and about four feet long. We found that when we tumbled the brick by themselves alone (without foundry shot) we got uniform results and develop uniform curves. When we used foundry shot, we did not get uniform results, we never could get a smooth curve. Our result on that matter has been the selection of the time of forty minutes and the tumbling of the brick without the foundry shot.

The next question to be examined into was the strength of the brick to carry a load. For that purpose I designed and built a testing machine to test the brick in cross breaking. The brick are tested on edge, and are supported on each end by rounded knife edges at a distance of six inches apart, the load being applied in the middle of the length with a third knife edge. We find that a good quality of vitrified paving brick tested under that condition will break in the middle, a poor quality of brick will splinter over one of the end knife edges. We further find that if there is any defect in the brick from its method of manufacture, bad burning, or bad annealing, that the break will follow the defect.

The next examination was as to the interior structure of the brick, that is, as to whether the brick was dense, whether the air had all been squeezed out of the clay when the brick was manufactured, whether laminations had been produced and whether all defects had been removed. For the purpose of examining into that question we simply split the brick up into small layers, very much as you would split up a stick of kindling wood. That is done by placing a brick on a narrow plate of iron a quarter of an inch wide, supported on a strong cast iron block, placing on top of the brick a three-cornered file and applying pressure from the machine until the brick splits. A good uniform vitrified brick, when treated in that way, will split very straight. I have split them into half-inch pieces; there is no trouble whatever in spliting a brick into four pieces that way. As with the cross breaking the test in sheering develops any internal defects that may exist. If the clay is improperly compacted or has air holes in it, the break in sheering will follow those lines only. A thoroughly compacted brick will give a clear, clean fracture. The strength of the brick we find to be a very good indication of its character. The further subject for investigation, which we are just preparing, is on the question of the absorption of the brick as affecting its durability under severe weather. That is to be ascertained by soaking the brick full of water and subjecting it as nearly as possible to the conditions which it will have to meet in the street, that is to say, by freezing the brick from the top down. It is proposed to do that with liquid carbonic acid gas. The freezing and splitting of a stone or a brick or any material of that character is done by forming a cake of ice around the exterior of the brick, which seals it water-tight. As the freezing proceeds, the water is crowded to the center of the brick until the pressure gets so great that it bursts. You take a stone that is at all laminated by frost and you will see these splinters of ice in it. Now, the brick when used in the street is exposed only at the top, as underneath it extends to a sand or a concrete cushion. The freezing from the top if occurring slowly will crowd the water down and into the space below and there should be no splitting from frost.

MR. KENNEDY, Covington, Ky.: I would like to ask which test you regard the best one and which will last on the street.

MR. HOLMAN: The problem that was laid before me was to develop a commercial testing that would be analytical. I have excluded all but two tests, the cross breaking test and the tumbling barrel test. The absorption test has been excluded for the reason that it takes too long to arrive at a conclusion. As far as all practical proposes are concerned, a cross breaking test and a tumbling test will give you all the indication that you want. When a new brick is brought onto the market you can determine carefully all its characteristics along all the lines that you wish, just as you do with a new cement brought on the market. The latter inspection of brick corresponds exactly to that of cement, that is to say, we are to see that the manufacturer is furnishing the quality of brick that he can manufacture, so that the commercial testing for the engineer is simply to see that the manufacturer is delivering his best goods, and to protest against accidents of manufacture which will occur in any concern, that is, the too quick cooling of the kiln or something of that kind. We find that with shale brick when they absorb over two per cent. of moisture, that the brick is not thoroughly compacted. We find with a fire-clay brick that they will absorb as high as four per cent. of water, but when they are split open the air is all out. The value of the vitrified brick depends first, upon the ability of the manufacturer to squeeze out all of the air that is introduced into the clay in the process of tempering and mixing, second, the proper burning, third, and most important, the proper tempering or annealing.

MR. WILKINS, Allegheny, Pa.: Speaking of this annealing process brings to my mind a test I made myself, a very crude one, to determine which brick will stand the freezing the best, shale brick or fire brick. I was prejudiced somewhat against the use of shale brick from my experience with shale building brick. I built a building some years ago out of shale building brick, which were good, hard, burned brick, and we had about a thousand or twelve hundred of them left over; they laid out on the ground all winter, covered with snow and ice, and in the spring when the snow disappeared the brick also had almost disappeared, had all gone to pieces and the pile looked like slacked lime. That fact rather prejudiced me against shale brick of any kind, and before I allowed the use of shale brick in our streets I took four "Mack" fire clay paving brick and four shale brick and soaked them four days in water. I do not remember what the percentage of absorption was for the different bricks, but it was almost the same, then I took those bricks to an artificial ice plant and I had them frozen for four days and then stood them in the hot sun and thawed them out and then repeated that process, and as far as inspection went I could see no difference whatever between the two bricks; both of them showed on the edge of the brick a very fine hair crack, you could hardly see it, both bricks showed the same result. The conclusion I drew from this test was that the shale brick would answer as well as the fire brick, as far as freezing was concerned.

MR. McCALL, Kalamazoo: We have a pavement of fire clay Hayden block; it is standing well and giving good satisfaction and is a favorite with some. The Canton 3x9" shale brick has no defects and has made us a nice pavement. We are a little inclined to favor the Galesburgh 2½x8 brick, of which we have a small pavement.

MR. HOLMAN: My remarks are intended only in a general way for engineers to establish a standard specification, which will enable the manufacturers to know what is wanted, and to furnish a guide as to the execution of the contracts. The results of our tests are not given with respect to any particular manufacture. We have had a great many different classes of bricks sent to us and have performed a great many tests, but we have not and do not propose to publish those tests as against any particular make of brick. We simply will give the result as a matter of general engineering interest to enable uniform specifications to be drawn for paving.

THE PRESIDENT: I would say before we close on this subject that it might be well for the Committee on Street Paving to take up especially the requirements of a paving brick test so as to establish it as a standard method for testing paving brick similar to the method established by the American Society of Civil Engineers for testing cements. Cements have been tested for ages, you might say, but these tests were of no value for the purposes of comparing because they were made under different conditions and that is the difficulty and trouble in comparing the results of the tests of paving brick made by the different societies, or by the authorities of the different cities, because they are not generally made under the same conditions or methods.

If the committee, which I think is thoroughly qualified to take this matter up, for they have given this subject a great deal of study, will indicate what is proper, uniform system to be applied in the method of testing paving brick, and the cities, or those who are in charge of that work in the different cities, will adopt it, then we will begin to accumulate information that will be valuable, and until that is done we are merely getting results in our own special cases which can be compared only with those that we have made heretofore, but not with those that have been made elsewhere and do not possess anything like the value that they would have if they could be compared with the tests made in all other cities in the country. These were the condition which prompted the appointment of a committee on a uniform system for tests of cement in the American Society of Civil Engineers. They made quite extensive investigations and tests and finally determined upon a certain system which has been generally adopted as the method of testing cement, hence these tests are very valuable because of the comparison that can be made.

It therefore occurs to me that if this committee will take up this subject and recommend a standard and uniform system for testing paving brick they will render the members of this Society a great service.

MR. THOMPSON, Peoria: As a member of the committee I would say that after investigating this subject thoroughly I think it would not be possible to recommend to this Society any standard for tests. The subject has not received the attention it should, and there have not been sufficient experiments showing conclusive results to warrant any committee at the present time in establishing a standard for conducting tests. The only thing that can be done before a satisfactory conclusion is reached will be for some Society to adopt a standard of tests, indicating what tests are necessary, the manner of conducting same, and the results that should be obtained, and for the engineering profession to correct the faults in such a standard as they present themselves.

MR. McCALL, Kalamazoo: What is the brand of the Louisville cement that has stood the most severe tests for all purposes?

Mr. Pearson, Louisville: I take a great deal of interest in this testing of vitrified bricks. We have about ten or twelve different kinds in use in the City of Louisville, and I am sorry to say that we have not a single one that will last over five years. I think we have laid them as well probably as almost any other city in the United States. We have put six inches of concrete down, then two inches of sand, and put the bricks on top as closely as they can be laid together, rolled them with a five-ton roller and then tarred the joints. There is none of these bricks but wear, within five years, very rapidly. I had to get up some specifications for bricks and came to the conclusion that the present tests—I may be a little hasty in saying it—are just a little absurd. In the first place the bricks are not subjected in the street to any of the tests which are usually applied for testing brick. The action of a horse's foot on a pavement and the action of a wagon wheel is entirely different from the direct crushing tests that we usually make for brick. The absorption test does not cut any figure at all, for we have sidewalk bricks in the City of Louisville that have been laid for thirty years, without a crack from frost, and I know our climate is worse than any other in the world for freezing and thawing. When it comes to the tumbling test, I verily believe you could take a loaf of bread and put it into the rattler and have it come out with less breaking up than the bricks themselves. I do not think any one of those tests are very good. My idea is that testing bricks can be done within forty-eight hours with a proper machine. In one of our brick plants in the City of Louisville we have a revolving table for the purpose of granulating the shale. My idea is, if some competent man who understands a great deal about machinery would get up a similar revolving table under a wheel similar to that of a wagon, loaded with 2,000 pounds on one four-inch tire, and let the wheel wobble as a wagon wheel wobbles (and if necessary put on another wheel which would revolve in the same manner, provided with a set of horse shoes with corks on that would give that tamping action just as a horse gives), and then lay the bricks on this revolving table, with the concrete and the sand under them and with tarred joints, just as laid in the street, we would have a proper machine to test brick for street purposes. Set the table to rapidly revolving and let the wheels have the wobbling motion of the wagon and the tamping motion of the horse, and I venture to say we will get a test that will tell us something about brick and their wear under traffic. I suggested to our Board that the best test we could make was to take a street we know is to have the maximum amount of traffic, divide it up into sections, put a granite binder between each section and lay each kind of brick that we can procure in this market, let the traffic onto it, and see which brick will stand this test the best.

MR. HOLMAN: I wish to state for the information of the gentleman that we have been all through that in St. Louis, putting up the machine and wheels and four-inch tires and wobbling them. We have gone through all that, and further, we have put pavements down and put the horses on them; what we are after now is to develop something practical that can be put into the specifications and can be used as a guide in filling them.

MR. SHERRERD, Newark: About a year ago I made some experiments in attempting to arrive at a means of testing the impact on brick. I did not conclude them, because a short time after starting the experiments I took charge of the Water Department and gave up direct charge of the brick pavements, but I went so far as to have a machine made on purpose to measure this impact. It was an idea of my own. I have not carried out enough experiments to give the results, but I would like to describe the machine briefly to see whether it could not be adapted to this very thing. It was made with a heavy bed plate on which the brick was placed and fastened in a V shaped rest, then a crank arrangement connected with an eccentric moved along on the bed plate by means of a rack. The eccentric was so arranged as to lift an arm about three feet long and allow the same to fall about eighteen inches. The end of this arm was provided with a knife-edge that came down and struck the corner of the brick, and for each revolution of the crank a blow was struck, and as the arm was raised for another blow the whole striking arrangement was automatically moved forward about a quarter of an inch. In order to measure the force of the blow, the striking arm could be balanced, and then certain known weights being placed on this arm the knife-edge could be made to strike along the corner of the brick, and by a reversing arrangement made to travel back over the same ground, knocking a small piece off every time the crank went around, and in that way you could get at an exact measure of the impact and subject any number of bricks to the same blows, both as to weight and number per inch of length. The pieces that were taken off the bricks we tested were so small that it was difficult to get a very good comparison. I intend to make a number of tests with this machine and see if it is not possible to get some results that will give comparisons. I think it would be a machine that would be a quick means of comparing bricks, and it would also give nearer the actual condition of wear that the brick receives in the street than the other tests, because in the rumbler there is too much of a sliding wear on the bricks, this is not had to the same extent that they get the impact. The machine could also be used with frozen bricks to give the effect of impact on bricks in this state.

Mr. Nevin, Louisville: I have laid as many brick pavements of all kinds of hand-made brick on sidewalks and on streets since we have been building vitrified brick streets than almost any other person in Louisville. I have made brick, moulded, burned and laid them on sidewalks. Have never seen a hand-made brick that the frost had any effect on, when taken up after thirty-five years use they would be as solid as when laid. The first vitrified brick pavement in Louisville was on Fifth street, between Walnut and Chestnut. The street between the car tracks was made of a mixed fire-clay brick, and the sides with red shale brick, the red shale brick in a year and a half wore very badly in several places, the fire-clay brick are still down between the car tracks as solid as the day they were laid. We have experimented with all kinds of brick, have put fire-clay brick in the roller with very heavy castings in the shape of brick, only larger than the common brick, and the brick that had the worst wear and tear in the roller took the least absorption, and the brick that stood the worst test in the roller stood the best on the street, and we think the mixed fire-clay brick is the best in our city, as far as the frost is concerned, have never seen any brick with which it made any difference about the swelling of the brick on the sides and lamentation in the middle. I think that comes altogther by improper drying and putting into temperature heating when the brick are not dry enough to put under such extreme heat. There is no reason why one brick will laminate and swell more than another, unless it is that it is not as dry.

MR. HOLMAN: In relation to the impact test, we have an impact testing machine. The difficulty is that the brick is too rigid. It takes a very small blow to break a brick. In order to develop the necessary foot pound resistance you will have to develop feet as well as pounds to absorb the blow delivered by the impact machine.

MR. NEVIN: This fall will be the fifth year that Fifth street has been laid with fire-clay brick between the car tracks and these cars are propelled by mules, and nearly all the wagon travel has been done between the tracks, and very little on the sides on account of the roughness of the pavement on the sides.

MR. CAPPELEN: I would like to ask the gentleman how cold weather they have.

MR. NEVIN: Frequently at zero and often 20 degrees below and very sudden changes.

MR. McCALL, Kalamazoo: I wish to ask for information in regard to the most advisable way of constructing Macadam streets. It is a new thing with us and I would like this information for the benefit of our City Council as well as myself.

There has been a great many brick makers in our City and the only thing that we can do to satisfy them every time they argue on the brick question is to take them out on the streets and show them the results.

THE PRESIDENT: The next paper on the program is by Capt. Lansing H. Beach, Captain Corps of Engineers, Washington, D. C., on "Regulations Concerning the Opening of Pavements by Corporations or Plumbers in the District of Columbia."

Captain Beach then read the following paper:

REGULATIONS CONCERNING THE OPENINGS IN PAVEMENTS BY CORPORATIONS OR PLUMBERS IN WASHINGTON, D. C.

BY LANSING H. BEACH, CAPTAIN ENGINEERS, WASHINGTON, D. C.

The streets of most cities of the country have but two parts, the driveway and the sidewalks flanking it. In Washington there is a third portion, termed the parking, which consists of a grass plat of established width for each street outside of each sidewalk. This grass plat can by permit from proper authority be fenced in so as to form a front yard or portion of the front yard of a dwelling, but the title remains distinctively with the municipality and the ground is as much under the control of the authorities as the driveway or sidewalks. On business streets permission is frequently given to pave it over and it then becomes to all appearances and purposes a part of the sidewalk. This parking varies in width on different streets from 12 feet to 40 feet, the streets themselves varying from 80 to 160 feet.

The city has 254 miles of street with the driveways paved July 1, 1896, as follows: Asphalt, 82.36 miles; coal tar, 22.30 miles; granite, 29.27 miles; cobble, 14.15 miles; macadam, 16.69 miles; asphalt block, 14.46 miles; vitrified brick, 0.20 miles; unimproved, 74.57 miles.

The general law governing excavations is laid down in Sections 1, 2 and 4 of Article XV. of the Police Regulations of the District of Columbia, which read as follows:

"Section 1. No person shall, without lawful permit, make an excavation in any public street, avenue or other public space, or remove from or deposit in the same any earth or other material.

"Section 2. No person shall, without lawful permit, destroy, cut or injure the footway or roadway of any street, avenue or other public place.

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"Section 4. No person shall, without lawful permit, erect a fence, wall, hitching or awning post, or plant a tree in any public street, avenue or other public place."

These permits are in general issued by the Permit Clerk of the District. All ordinary cases of plumbers' and gas company cuts are covered by Sections 20-32, 34, 67, 139 and 140 of the Plumbing Regulations, which are as follows:

"Section 20. It is required that each permit for an excavation in public street be taken out before the work is commenced; that it be kept at place of excavation while the work is being done and be exhibited whenever called for by the police or other persons having authority to examine the same; that no authorized underground construction be injured or interfered with; that no asphalt, coal-tar, concrete, granite, or other improved surface be disturbed, unless a deposit shall have been made to cover the cost of repairing the same; that, subject to the provisions of these regulations, all portions of the street excavated be put in as good condition as before the excavation was made; that the trench be filled up and thoroughly rammed (and puddled, if required) within forty-eight hours after making the connections or repairs, the ramming to be done in six-inch layers; and that all rubbish or other foreign material be removed within the time designated for the completion of the work, after which the permit shall become void and of no effect; that during the execution of the work the trench be suitably guarded during the day, and that it be thoroughly covered or securely barricaded from sunset to sunrise, and that lighted red lamps be so placed before dark, every night, as to prevent accidents to persons or animals passing along the street; and that the District of Columbia be protected and saved harmless from the consequences of any injury to any person or property, due to the execution of the permit issued by said District of Columbia to any person or corporation, to excavate in any public street.

"Sec. 21. Application for permits to excavate in any public street for the purpose of doing any work contemplated in Section 10 must be made to the Permit Clerk. (See Sections 22, 24, 32, 34, 67, 139 and 140.) Blank forms of application will be furnished to registered pumbers and the representatives of companies having gas mains, subways or conduits in the streets. One dollar shall be paid as permit fee for each building, lot, premises or establishment connected, and for each excavation made for repairing pipes or other underground structures, and the receipt of this fee must be entered upon each application. The fee must, in all cases, be paid before the application is presented to the Permit Clerk. No fee, however, will be required for a permit to make connection with any public sewer, house sewer water main, gas main or service pipe when all the work, including the place of connection, lies wholly within the limits of private property, nor for the adjustment to grade of a down-spout connection and clean-out, the adjustment to grade of a fresh-air inlet and clean-out, and the removal of a standpipe used for supplying water for building purposes; but, in every case, a permit must be taken out, as required by Section 10. Every application for a permit for work to be done under Section 10 shall be signed by the owner of the premises, whose address shall be written under his signature, and by the registered plumber or person who is to do the work. Signature by agent shall not be accepted if the owner resides in the District of Columbia. Any licensed plumber presenting a fraudulently signed application shall have his license revoked. Each applicant must state the street and number of the building, premises or establishment, and, also, the lot or sub-lot and square.

"Sec. 22. Blank forms for emergency permits for repairs to sewer and water pipes shall be kept at each police precinct station. The senior officer on duty is authorized to issue these permits to licensed plumbers in case of emergency, but only when the permit office is known to be closed; and the officer issuing such emergency permit shall promptly transmit a report thereof, through the proper channels, to the Permit Clerk The emergency permit shall in no case take the place of the regular permit, for which the plumber concerned shall apply during the first succeeding day on which the permit office is open.

"Sec. 23. All fees and other charges connected with permits issued or to be issued under these regulations must be paid to the Collector of Taxes of the District of Columbia, who is the only officer authorized to receive them.

"Sec. 24. Every application to connect a building, lot premises, or establishment with a water main, water service pipe, public or private sewer, gas main, conduit or subway, or other underground structure, or to repair a house sewer or service pipe for water or gas, must state the exact location and number of the building or premises, and the number of the lot and square. (See Sections 21, 34, 37, 67 and 139.)

"Sec. 25. All cuts in sheet asphalt and coal-tar surfaces shall be repaired by the contractor doing similar work for the District government, and all cuts in blocks and similar pavements by the Superintendent of Streets

"Sec. 26. As soon as possible after a cut has been made in any paved carriage-way, or in any footway laid with other than ordinary brick pavement, it shall be filled in, as required by Section 20, by the plumber or other person making the same, after which it shall be taken in charge by the District authorities.

"Sec. 27. No person shall, without special written permission from the officer in charge of surface work, tunnel under the carriage-way of any street to a greater distance than four feet from the curb thereof, for the purpose of doing any work governed by these regulations. The surface of the pavement shall be removed to the same width as the earth in the trench below the surface.

"Sec. 28. All plumbers or others removing valuable material from the street, such as granite blocks, asphalt block, etc., shall be held accountable for the same until it is relaid by the District, and any of this material lost or injured shall be charged to them. In case the plumber or other person making the excavation so elects, he may haul the material to the District property yard and take a receipt for the same, when his responsibility for it shall cease.

"Sec. 29. Each registered plumber shall, before being granted a permit to make a cut in any paved street, deposit the sum of fifty dollars ($50.00) with the Collector of Taxes, which amount he shall keep good whenever called upon by the Engineer Commissioner to do so, and which shall be used in repairing pavements cut. The following rates shall be charged for repairing cuts:

Sheet pavement, 35 cents per square foot.

Granite-block pavement, 15 cents per square foot, and 5 cents for each granite block lost.

Asphalt block pavement, 15 cents per square foot and 7½ cents for each asphalt block lost or broken.

Granolithic pavement, 25 cents per square foot.

Vitrified brick, 15 cents per square foot, and 2 cents for each vitrified brick lost or broken.

Macadam and Telford pavements, 15 cents per square foot.

Cobble pavement, 5 cents per square foot.

"Sec. 30. After the filling of any trench in a brick sidewalk, the latter shall be immediately relaid by the person to whom the permit was issued, in accordance with the specifications of the Engineer Department for similar work in force at the time, and shall be kept properly surfaced for two years thereafter. In case the original repairs are not made at once, and any subsequent repairs needed are not made within three working days after the receipt of written notice from the Permit Clerk of the necessity for the same, the plumber's license shall be suspended, and the Commissioners will order the work done in such way as may appear most convenient and expeditious, and charge the sum of the cost of the same to the plumber. The latter's name shall not be restored to the register until such expense as shall have been incurred is paid.

"Sec. 31. The work of repairing plumber's cuts in any portion of a street for the pavement of which street railroads are responsible, shall be performed by the contractor doing similar work for the District government, or by the Superintendent of Streets, and the cost thereof shall be paid out of the deposit of the plumber concerned.

"Sec. 32. Every plumber whose balance of deposit has fallen below ten dollars ($10.00) shall be notified by the Engineer Commissioner to make good such balance, and no permit to make an excavation in an improved street shall be granted any plumber who shall fail to make good his deposit. No permit to do any work contemplated by these regulations shall be granted to any plumber who shall fail to settle his indebtedness to the District, after receiving due notice thereof.

"Sec. 34. Every application for a permit to make connection with the system of Potomac water mains, or service pipes attached thereto, or to repair a service pipe outside the building line, must state upon the blank form furnished for the purpose the number and exact location of the building, premises, or establishment; the number of the square and lot or sub-lot; the number of stories and front feet; the purpose for which the water is to be used; and the time at which the tap will be required to be made by the Water Department.

"Sec. 67. Every application to connect a building, lot, premises or establishments with a public or house sewer, or to repair a house sewer, must state the exact location and the number of the building or premises, giving the number of the lot and square, the approximate frontage and depth of the lot, whether the building is to be drained toward the front or rear, whether the proposed house sewer is to be of iron or vitrified pipe, and the time when the inspector or sewer tapper will be required to be present to inspect the house sewer and the connection made with the public sewer. (See Section 10 and 69.)

"Sec. 139. Permits shall be issued by the Permit Clerk, upon application, on forms provided for that purpose, to the proper officer of each company owning gas mains, subways, conduits, or other underground structures, to run service pipes or branch conduits from its mains to private premises, and to make necessary repairs.

"Sec. 140. The usual fee of one (1) dollar shall be charged as a permit fee for each house connected by service pipe or branch conduit, and for each excavation made in the street for the purpose of repairing, altering or extending any main, subway, conduit, or other underground construction."

The Permit Clerk is provided with maps of the city on a scale of fifty feet to the inch showing all underground constructions, and these give him sufficient information to enable him to act intelligently upon all ordinary cases of plumbers' cuts. Special cases are referred to the head of the sewer, water or street department, according to its nature, for decision.

The gas company is required to submit a map of any desired extension or change of pipe with a written description of the route; this paper is then referred to the sewer and water departments successively for examination to ascertain whether the proposed line will interfere with existing or contemplated underground constructions. After report by these departments the papers are sent to the Permit Clerk for issue of permit.

For corporations other than gas and electric light companies and for these companies in all cases other than the usual extension of line for house connections, a special permit is required. In most cases a deposit sufficiently large to repair the pavements cut and to repair damages to water pipes or sewers and to defray the cost of any changes in the latter has to be deposited with the District in advance, or in case of a large work, a stated sum varying from $1,000 to $5,000 is so deposited and the balance not allowed to go below a certain figure. The following permit is quoted as a fair specimen of its class.

"Washington, February 26, 1896.

"Ordered:

"That upon depositing one thousand (1,000) dollars with the Collector of Taxes, D. C., the Permit Clerk is authorized to grant a permit to the Metropolitan Railroad Company, to lay temporary tracks not unreasonably obstructive, and to open the streets for the construction of its underground electric road on its line on 4½ north of L, 9th, 7th, extended, and on Florida avenue, 7 to 10th streets, under the following conditions, viz.:

"All work shall be done at the risk and expense of the Metropolitan Railroad Company and said company shall be responsible for any accidents or damages caused by or due to any work that may be done by it or others in connection with the construction of said road. Said company shall, during the construction, keep open for travel a sufficient and reasonable width of all cross sidewalks and roadways, so as to incommode the public as little as possible.

"There shall not be open at any one time more than six squares and this number may be modified by the Commissioners of the District of Columbia, if deemed necessary by them, nor shall any place in the street be kept open more than sixty days.

"Said company shall deposit, in addition to the one thousand dollars, such further sums as the Commissioners may deem necessary, to defray such expenses as may be incurred by the District of Columbia in connection with the inspection of the work and in making good all damages to any District work injured and in restoring all pavements disturbed by changes made in connection with said work in sewers, water and gas mains or other underground construction in the streets; Provided, That when the work is finished such amount as shall not have been expended shall be returned to said company within ninety days with statement of account in full.

"Said railroad company shall restore, repair and repave the streets and avenues along the lines of its road that may be cut, damaged or injured by it in consequence of the reconstruction of its road and put the same in first class condition to the satisfaction of the Commissioners and shall keep the same in good repair for a period of time such as is usually required in contracts by the District for similar work; Provided, That if said company shall refuse or neglect to do said work or make such repairs, the District of Columbia may do the same and charge the expense thereof to the company.

"If deemed necessary there may be employed by the District of Columbia and paid out of the deposit of said Company, an Inspector at four ($4) dollars per day for each working day, who shall carry out all orders that may be given him by the Commissioners or their agents, and shall also report to said Commissioners any cuts in the pavements of streets torn up for which said company is not responsible.

"Wherever the grade of the tracks of the railroad shall not be on the grades of the present paved street, all expenses of making the same conform with said grades shall be borne by the company.

"All paving material taken out of the streets and not previously paid for by the said company shall be hauled to a District property yard, or to such other place as the Commissioners may direct; Provided, That the haul be no greater than to nearest District property yard, at the expense of said company.

"The kind of pavement placed on the part of the street for which the company is responsible shall be subject to approval of the Commissioners of the District of Columbia.

"Every precaution against accidents shall be taken, such as barricading the work and lighting the same, and also piles of material at night, as provided by law or the regulations of the Commissioners of the District of Columbia.

"The tracks must be laid in accordance with plans on file in the Engineer Department, and to the exact grade given by that Department. No projections of any kind will be allowed above the surface of the pavements. The construction of the road shall conform in all respects to the specifications filed in the Engineer Department by the Metropolitan Railroad Company.

"Construction material may be deposited near the curb so as to obstruct the street as little as possible, providing that upon 9th street, between Pennsylvania avenue and G street, no material be deposited until the work has reached within one square of this portion of the street."

The Permit Clerk reports to the Superintendent of Streets each Monday morning all permits issued during the preceding week involving cuts in pavements, giving the plumber's name, the locality and the character of pavement disturbed. These reports are turned over to the foreman in charge of street repairs, who generally makes the repairs in about seventeen days from the time the trench was filled by the plumber. The plumber himself is allowed to repair macadam, cobble and brick pavements if he desires, and if the work is done satisfactorily no charge is made against him by the Street Department.

It may be said in conclusion that the regulations afford such a description of the manner in which the work of making cuts in the streets is carried on and controlled that any further explanation of the methods of this city would merely involve repetition.

THE PRESIDENT: The next paper is upon "Regulations for Opening Paved Streets," by Mr. G. D. Snyder, City Engineer, Williamsport, Pa.

MR. THOMPSON: Mr. Snyder is not present and will not be here to-morrow. I have his paper and either I or the Secretary can read it.

The Secretary then read the following paper by Mr. Snyder:

EXCAVATIONS IN CITY STREETS.

BY GEORGE D. SNYDER, CITY ENGINEER, WILLIAMSPORT, PA.

No more difficult problem has to be solved by the city officials than the adoption of satisfactory regulations relating to excavations in public streets and the tearing up and relaying of pavements caused thereby. There is nothing more aggravating both to the general public and to the city official than to see a street that has but recently been paved, torn up to gain access to the underground pipes and conduits, and the pavement but indifferently replaced. The city official feels that all his care and attention to the preparation of specifications, the testing and selection of material and to the execution of the work in its most minute details has been so much time wasted. The general public feel that they are not getting the worth of their money, as they have paid for and received a smooth and durable pavement but see little prospect of it remaining such.

There are about as many different regulations relating to this subject as there are cities. In some the persons digging up the streets are under practically no restrictions at all. while in others, the regulations are so strict as to make their inforcement to the letter practically impossible. In some places persons desiring to dig up the streets are required to give a bond to restore the pavement to its original condition and maintain it so for a specified time. In others they make a deposit of a sum of money to cover the cost of replacing the pavement, while in others a certain fixed sum per square yard for excavating the different kinds of pavement is paid. The practice of requiring a deposit of a sum of money greater than any possible expense to which the city can be put in replacing the pavement, is perhaps the best, as the exact number of yards to be torn up cannot generally be determined beforehand, and to collect money on a bond is not always easy.

Some cities, after paving a street, will not allow it to be torn up for any purpose during a fixed term, such as two or three years. Such a regulation, however admirable it may be in its purpose, seems impossible to carry out on account of the difficulty of ascertaining all the necessary repairs to underground pipes before the pavement is laid, and from the fact that no man can tell when a serious leak in a gas or water main, or obstruction or break in a sewer, may make the tearing up of the street imperative.

The writer will briefly give the practice in his own city in regard to tearing up and replacing pavements, not because he believes it cannot be improved upon, but in order to bring the matter before you in the hope that it will be thoroughly discussed and the good points in the practice of other cities brought out.

In the city of Williamsport when an ordinance for the paving of a street has been passed, the city engineer notifies all corporations having pipes in the streets to make all necessary repairs or renewals to the same. He also notifies all abutting property owners to make all necessary gas, water, steam, sewer or other connections before a certain date, when the street is turned over to the contractor and after which no permits are issued for such work. In default of the property owner making these connections they are made by the city at his expense. At the same time the city completes the sewer system under the area to be paved, building sections of sewers across the street whenever necessary for future extensions.

In carrying out the above provisions an effort is made to anticipate as much as possible all new underground work that will be necessary during the life of the pavement, so that all future excavations will be limited to absolutely necessary repairs.

Try as you will to avoid it, it becomes necessary at times to excavate in the paved streets, and our city has provided that such work be done as follows: When an individual or corporation desires to make excavations in the public streets, they must apply to the City Engineer for a permit. The City Engineer makes an estimate of the cost of replacing the pavement and maintaining it for one year. Upon the payment of this amount the permit is granted, provided that the object for which the excavation is made is a legitimate one.

Any corporation wishing to extend their pipes or conduits on any street must file a plan showing the proposed location with the City Engineer for his approval. If this location interferes with the line of a contemplated sewer or other city work, it must be changed.

The trench is refilled by the person taking out the permit and the street surface is restored by the city. All pavements that have been guaranteed for a term of years are replaced by the contractor who constructed them.

When a contractor bids for the construction of a pavement that is to be guaranteed for a term of years, he also names a price per square yard for which he will repair all openings made in the pavement during the term of his guarantee. The object of this provision is to prevent the contractor from attributing the condition of the street at the end of his guarantee to the defective manner in which openings have been repaired.

A permit for excavating such a pavement is charged for according to the number of square yards to be opened at the rate bid per square yard.

Pavements not under a guarantee are all replaced by city employees. The city has prescribed the manner in which refilling shall be done and provided a penalty for nonconformance therewith, but this is very difficult to enforce and some careless refilling is done. The remedy for this would be to either have the ditches refilled by the city force or under city inspection, but as the law does not provide for this at present, we have endeavored to replace the pavements in a durable manner in spite of more or less indifferent refilling.

We have accomplished this as a rule by the use of concrete foundations. Concrete as a pavement foundation has many advantages. It can be readily laid in small patches and can be made to join on to most any kind of foundation. One of its great advantages is that it prevents any water finding its way into the trench from the surface. No matter how carefully a trench is refilled, if water finds its way to it it will settle. We have therefore used concrete to replace broken stone foundations of brick pavements and to replace the Telford base of broken stone pavements.

Where foundations are replaced by concrete the pavement is removed to a greater width than that of the trench, so as to give a shoulder of firm ground for the concrete to rest on, in case the trench should settle, the concrete forming a bridge to support the pavement.

Concrete is thus used for repairing all pavements excepting wooden block. As the few remaining pavements of this kind that we have are rapidly being replaced with those of a more permanent character, it has not been thought worth while to repair them with anything but a plank foundation, such as they orignally had.

On the unimproved streets the trenches are refilled with a slight crown above the general level of the street and left to settle. Should the trench settle below the level of the street, it is filled up with broken stone or gravel.

The charges made for excavating permits are about as follows:

Asphalt, per square yard	$3.30
Brick, per square yard	3.00
Broken stone, per square yard	1.50
Chestnut block, per square yard	.50
Unimproved streets, per square yard	.25

In winter openings have to be repaired temporarily until the weather will admit of permanent repairs, and an additional charge is made.

The proper manner of refilling trenches is a subject upon which there is much difference of opinion. A great deal has been written as to the relative advantages of tamping and puddling. It seems, however, to be a subject upon which no general rules can be laid down. It is hardly wise to speak of gravel, sand clay, loam, etc., and to say that certain of these materials should be puddled and others of them tamped, when materials bearing these names have such totally different characteristics in different sections of the country, or even in different sections of the same town, as to require totally different treatment.

The assertion has been made that the proper solution of the problem is to replace, by whatever means, all the material taken out of the trench, allowing for the displacement of the pipe or whatever is buried therein. Yet I have no doubt that many of you have seen all the material and more too, in addition to a pipe replaced in an excavation, and yet a settlement would occur. On the other hand, with some materials it seems physically impossible to replace anything like all the material and yet such a trench often does not settle.

One of the solutions of this problem that has been suggested was to refill all trenches with sand. This seems to be a needlessly severe requirement to lay down as a general rule, although with some unstable materials it might be highly necessary to use sand or even gravel or broken stone.

The problem is complicated in some instances by the contractor guaranteeing and maintaining the pavement for a term of years, and in others by a street railway company having to maintain the pavement. While corporations owning pipes in the streets should not be allowed to damage pavements without duly compensating a city for them, these corporations supply the citizens with some necessity, such as light, water or heat, which nearly every citizen must have. It must not be forgotten that any undue restriction on such a corporation must eventually be paid for by the property owner. With all these conflicting interests the problem becomes a different one in every city, and must be worked out by each for itself.

What would undoubtedly be the best and cheapest treatment of this problem in the long run, would be to construct conduits of sufficient size to contain all pipes and the electric wires as well, and admit of access to them. If our cities were built all at once, it would certainly be the thing to do, but nearly all cities counting on future growth have such a large allowance of sparsely settled territory, that the cost at first would be prohibitory, and when the city is sufficiently settled to warrant such an expenditure, the cost and inconvenience of changing and abandoning existing conduits owned by diverse interests prevents such projects from being carried out.

In describing the practice of repairing streets in Williamsport, I have stated what we try to do, and not what we always accomplish, for nothing is more difficult than to have work done in small patches equal that of original street, and if we wish to maintain the uniform surface of our streets we must pay, as for liberty, with eternal vigilance.

THE PRESIEENT: The next paper I will call for this evening is by Col. N. A. Downing, upon the subject of "Improved Streets and Care of Same."

Col. Downing then read the following paper:

IMPROVED STREETS AND CARE OF SAME.

BY M. A. DOWNING, CHAIRMAN BOARD OF PUBLIC WORKS, INDIANAPOLIS, IND.

The City of Indianapolis, which I have the honor to represent at this convention, lays claim to greater advancement in municipal improvements during the past five years than any other city of her class in the country. She now enjoys the reputation of being a beautiful city; a city possessing fine well-shaded residences and good business blocks; a city which now has fifty miles of permanently improved streets as compared with two miles in 1891. The street improvements made in our city during this period has cost to exceed the sum of three millions and a half of dollars, which does not include an expenditure of over a million dollars on an adequate sewerage system. The increase in population, from 107,000 in 1891 to 170,000 in 1896, is due, I believe, more to advancements made in municipal improvements than to any other one thing. Why should this not be true, when it is known that we are now passing through one of the greatest financial strictures this country has ever experienced?

On the subject of street improvements, to which I am more particularly expected to confine my remarks, I beg to say: This subject is one upon which all of us do not agree. By this I mean to say that different municipal Boards have varying ideas as to what is best suited for use in the make-up of permanent streets, and this is true of the four Boards which have had charge of the Department of Public Works in Indianapolis since 1891. Each Board has, in its turn, served the city faithfully and under it the city has been materially benefited in the construction of pavements and sewers. There seems to have been unanimity in the views taken as to what the character of foundation shall be. It is the practice to lay all pavements upon a six-inch concrete foundation. This is varied from but little—the exceptions being a few asphalt surfaces which have been laid on streets in the suburban portions on a four-inch concrete base and the laying of a mile or two of brick surfaces in alleys on a broken stone foundation. A concrete foundation is now recognized by all municipal improvement Boards in the cities of the country as standard.

Our 50 miles of improved roadways are made up of 28 miles asphalt, 15 miles brick, 5 miles cedar block and 2 miles of macadam pavements. The policy of the Board has been to give the property owners that character of an improvement which a majority of the resident property owners on the street desire. Many of our property holders and the Board of Public Works have views favoring the use of wooden block pavements.

Our information on the subject of asphalt pavements leads us to believe that it is an easy matter to lay an inferior street. The success of its construction depends largely upon the proper mixture of the different ingredients, and all this, too, at a temperature which should vary but litttle. A failure to secure the proper mixtures and the right temperature results disastrously in the wearing ability of the pavement laid, and Indianapolis has suffered some from this cause. While we are aware that it is an impossbility to secure a material for street paving which does not require, from time to time, repairs, yet we do believe that materials other than asphalt (unless improvements can be made in the manner of their construction) can be selected which will give better and more lasting results.

The use of brick for paving purposes is not much in favor in Indianapolis. In 1891 several miles of brick pavements were laid and the material used proved to be inferior—so much so that we are now replacing much of the old surface with new brick. This was occasioned by the use of 2"x4"x8" brick which would not stand the traffic to which the street was subjected. We have, in every instance during the present season, adopted for use the large block, which, being burned to the proper hardness, will stand, it is believed, heavy traffic for from ten to twelve years, and if the traffic is light will wear and be in good condition for a correspondingly longer period. Brick is a good material for use in alleys and is used, no doubt, principally for that purpose in many of the cities represented here.

The construction of macadam streets has been discouraged by the present administration in Indianapolis. We have just completed and accepted two miles of such pavements. Our Common Council has refused to restrict heavy traffic from the pavement and this will prevent, in a great measure, that degree of care which should be constantly exercised to keep the pavement clean and in repair. It is a roadway which, if not properly sprinkled, cleaned and kept in repair, restricting at all times heavy traffic teams from using it, will deteriorate in spite of the utmost vigilance.

I am aware that some of the leading cities in the country have discarded wooden blocks for use as a street paving material and what views I have to present in their favor will, perhaps, not be in accord with ideas to be advanced by many of the delegates to this convention. I think I am correct in saying that 99 out of every 100 wooden block pavements laid in this country have been put down on either a sand or board foundation—the surface consisting of round or rectangular cut blocks untreated with a preservative of any kind.

An agitation, during the Spring of this year, on the subject of wooden block pavements, resulted in the City Comptroller of Indianapolis and myself visiting the cities of Galveston, Texas, and New Orleans, to ascertain as to the merits of yellow pine blocks treated with creosote oil. We made a careful examination of this material. In Market Street, Galveston, samples of yellow pine block were taken which had constantly been subjected to heavy traffic since 1875. They were found to be as sound as the day laid and are blocks which are indistructible so far as decay is concerned; are impervious to water and free from microbes. So well had the creosote oil been retained in the block that it was possible, under pressure, to extract it. The pavement from which this sample block had been taken was, however, somewhat uneven, owing to the imperfect foundation of sand on which the blocks had been laid.

A sample of a large yellow pine block was taken from a pavement laid in 1872 at the main entrance to the works of the New Orleans Gas Light Company, which, during the past twenty-four years, had been subjected to the severest test in the way of heavy hauling that any pavement in that city could be subjected to, being used exclusively on which to haul coal and coke, used and produced in the making of gas. This as evidenced by a certificate from Auditor O'Neil, who has been with this company forty years. This pavement was found to be in perfect condition, showing no indication whatever of decay and little of wear. It had been laid with creosoted blocks laid upon a tarred board foundation and was the only pavement of that kind in New Orleans.

A granite block pavement had been laid in the street adjoining this drive-way and consequently had been subjected to the same heavy traffic as the wooden blocks. It was quite apparent, on examination of the two pavements, that the granite pavement had worn down a depth of 1½ inches while the wooden block only showed a half inch depression.

To successfully creosote blocks, all the sap and moisture must be extracted by means of a vacuum pump. The crosote oil must then be forced into the block under pressure from 70 to 100 pounds using 12 to 14 pounds of oil to every cubic foot of block.

As a result of this investigation the following conclusions were reached as the proper method to be pursued in laying block pavements, that is to say, such a pavement as could be subjected to heavy traffic for a period of from twenty to thirty years and yet remain and be in good condition:

1st. The use of yellow pine block, treated with creosote in the manner before described.

2d. A large sized block to be selected, the dimensions to be not less than 4x6x9 to 12 inches long.

3d. The foundation to be of concrete six inches in depth.

After a thorough investigation as to the merits of the different woods, the Board was led to believe that the long leaf yellow pine was the best, from the fact that the fiber is very strong and will stand any amount of pounding. To aid the Board in coming to this conclusion, as a proper solution of the question, were the representations made by many of our reputable citizens who had visited London and Paris, in which cities it was shown that such material had been used in the manner described and the results obtained were satisfactory.

To secure the best results, the Engineer in charge of the work for the city must employ competent inspectors, whose duty it shall be to make the most rigid inspection of all work done. The blocks must be planed to a uniform depth and thickness. This to insure a perfectly smooth surface with practically no interstices.

This will be the character of wooden block pavements which we will provide for Indianapolis during the period in which the present administration shall have charge of her municipal affairs. It will be a pavement easily kept clean; is free from that noise which is so annoying to many property owners living on brick and asphalt streets; is favored by owners of vehicles for the reason that it is not injurious to the horse, and in many other respects has advantages over other pavements.

Indianapolis will require an appropriation of $60,000 to keep clean improved streets during the year 1896. This is work paid for from the general fund of the city. Under the contract now in effect the city is paying from

28c to 30c for the cleaning of every 10,000 square feet of street. Our business streets are swept daily; the resident streets tri-weekly. Between sweepings men are employed by the contractor to take up the street droppings. We have in use the broom sweeper and the Furnas Pneumatic sweeper. The cleaning of our streets is under the direct charge of the Board of Public Works and there is no duty imposed upon us of more importance than to see the district enforcement of the existing contracts for the cleaning of improved streets. A city can spend large sums of money to improve roadways, but if a pavement, after completion, is not regularly cleaned and kept in repair, the benefits to be derived and the pleasure resulting therefrom is greatly diminished, and the effect of the expenditure made in the first instance is lost.

THE PRESIDENT: Gentlemen, these papers that have been read this evening are now open for discussion. We miss the paper on "First Cost and Maintenance" by Mr. Williams, which has not been sent in to the society, nor is Mr. Williams, as I understand it, present. The other two papers will be postponed until to-morrow morning and the discussion will now be taken up upon the papers that have been read this evening.

MR. BEACH, Washington: I would like to make a remark or an explanation in regard to Col. Downing's statement that the length of life of the wooden block pavement was due to creosote. The City of Galveston is very peculiarly situated, it is rather an exceptional city in this country. The highest point is only ten feet above salt water and you can hardly dig, even in dry weather, more than two feet down without striking water. They have had the cypress block pavements there without any treatment, they have taken the ordinary block pine and it has remained twelve, fifteen and in some cases seventeen years, without showing any signs of decay or any appreciable wear, so that in that locality it is hardly fair to claim that creosoting will give any special life to blocks. I want to call attention to the special conditions in that locality with regard to wooden pavements.

MR. VAN DUYNE, Newark: I would be sorry if any city coming here for information was led to put down wood pavements this year of our Lord. In New Jersey our adjoining city, Elizabeth, was bankrupted some twenty-five years ago by putting down wooden pavements. They used creosoted and almost every other kind that was in use, and of course in not a very long time it rotted down before the assessment was even paid for in a great many cases, and to a very limited extent we had the same experience in Newark. I do not believe the conditions are such as to justify any city in going into wood pavements. In some of the streets of Chicago you see the evidences of wood pavements and the decay they are subject to.

Mr. Kennedy, Covington, Ky.: Did you ever try locust block pavement? We have in Covington a locust block pavement of one square that is now standing that has been down for fourteen years, but it is locust block; you all know what locust is. It is very lasting timber; it never does rot. But, as to pine, we tried that; we never had any last five years, but locust lasts very well. It is difficult to get locust enough to pave our streets.

Col. Downing: Most of the wooden pavements made out of pine in this country have been laid with white pine, and the fiber is nothing like the Norwegian pine. About Galveston being an island, that is true, and the blocks are laid simply down on the sand. But we do contend and we know it to be true that creosoting these blocks, where twelve pounds of creosote are used to the cubic foot, that it does lengthen the life of the block, that it makes it impervious to the water, that so far as the wear and tear of the block is concerned it will bear more pounding, more traffic than any granite street. There is no doubt about that, and if you will take the trouble to investigate it you will find it to be true as we have.

The President: There is no doubt but that wood thoroughly prepared and impregnated, laid upon a proper foundation, will give entirely different service than the common wood block pavement that has been used in all the cities throughout this country. Wherever wood has been prepared, either by creosoting or Thilmanizing, or by any of the other approved processes of preservation, the same has not been worn down rapidly nor has it been subject to decay. The wood has almost generally been as sound after a service of ten, twelve or fifteen years as it was the day it was put down. The trouble has been, though, with this kind of preserved wood block, that it has been laid on a poor foundation and the pavement has gone to pieces for that reason. Some twenty years ago wood blocks preserved by the Thilmany process were laid on quite a number of streets in the city of Milwaukee on a plank foundation resting upon a sand bed. Some of these blocks are still in existence on that part of the paved streets that has not been subject to much travel or where the same has not been opened for the purpose of laying mains or service pipes. I think a year or so ago some of the pavement was taken up and the wood was in good, sound condition, and was so thoroughly impregnated that when you cut it with a knife evidence of the presence of copper was to be seen upon the blade. Of course in many of these processes of preserving wood the utmost care is not always given to the extraction of the sap and consequently it is impossible to saturate the timber with the material that was to be used as a preservative.

I suppose you are all aware that in continental cities, like Paris and London, in order to overcome the annoyance of the noise of a granite or Belgian block pavement an Australian wood has been laid upon concrete. The expense of that wood, of course, is a barrier against its ever being extensively introduced into this country. Wood, if it is thoroughly impregnated, may be said to possess all the qualities requisite to good service for a street pavement. However, I suppose that if you lay concrete foundation and go to the expense of thoroughly impregnating the wood block such pavement is about as expensive as an asphalt pavement at the present time. I merely speak of this to disabuse you of the idea of comparing wood pavement laid with impregnated blocks with the wood pavement as laid to-day. There is a considerable difference, and the impregnated wood block laid on a good concrete foundation has some merits which a common block pavement, either pine or cedar, laid on sand or plank, has not. I do not know that the latter has any merits except that it is cheap.

Col. Downing: I only want to say a word and I want to say it to you so that you can make a thorough investigation. At Indianapolis the Mica Roofing Company has constructed a plant in which they make a great deal of oil. When we came back from Galveston and New Orleans they put up a creosoting plant. This plant consisted, in part, of a steel cylinder seventy feet long and six feet in diameter. Then they had ten truck cars built which they loaded up with blocks. While five of these truck cars are run into the cylinder on tracks, the other five are being loaded with blocks. After the blocks are run into the cylinder, steam is turned in so that the blocks become thoroughly saturated and soft. The vacuum pump is then put on and all moisture is extracted from the blocks, after which the creosote is forced into the blocks—each cubic foot containing from 10 to 12 pounds of the oil.

Now, I want to say in regard to Galveston that yellow pine blocks are used exclusively there, being laid on a sand foundation In Market street, where the traffic is heavy, the city authorities tell me that for 21 years the expense of keeping such a pavement in repair had not cost the city twenty-five cents. Now, the truth is that in Europe these blocks are being laid. Any one who wishes to make a test of yellow pine will find that it is nearly as strong as hickory, will stand any amount of pounding and it is almost impossible for a horse to tear a piece out of it, while in cedar blocks this is an easy thing to do. We have about five miles of cedar block pavements which was built last year. The cost of this character of pavement, after creosoting the blocks, is a little more than asphalt, but the pavement is not noisy, it is not dusty, the people there want it and we are willing to take our chances and give it to them. The blocks that were taken up had been down 24 years. I have telegraphed for one of the sample blocks and it will be here. You will find it as sound to-day as when it was put down.

Mr. Stainsby, Newark: It seems that the East lies between Europe and the West, and Southwest. They may stand well in Europe and may stand well in Western countries, but I do not think there is any city in the East that has undertaken any great amount of wood pavement with success. It certainly has ruined a great many cities East. We had all kinds of patent inventions and things of that sort. I am not a mechanic enough to know about creosote. I know at the time my friend speaks of, we spent about $2,000,000 on wooden pavement in Elizabeth. I want to say, at that time I was a wood pavement man myself, but I never was so happy as when I found the Mayor of Newark had vetoed the ordinance for wood pavement. I do not think Newark will spend very much time in talking wood pavement. Perhaps it is in the climate, or in the method of doing it. There is something between Europe and the West that prevents our doing much in the wood pavement line. It does not stand at all with us.

MR. WILKINS, Allegheny City: Five years ago the Brooklyn Suspension Bridge Company between Allegheny and Pittsburgh, tore that bridge down at an expense of nearly $600,000, and built a new bridge, of which Mr. Cooper, of New York, was the consulting engineer. They wanted the best structure in every way that they could get, not only as far as iron work is concerned, but with the pavement. Mr. Cooper, after investigating the block pavements in London, thought that he had got a pavement which would be just the thing for that bridge. The floor of the bridge was composed of buckle plates, then six inches concrete on top of the buckle plates, then white oak blocks, four inches thick, five inches deep and not exceeding ten inches in length. Those blocks were laid with joints three eighths of an inch; the joint was kept uniform by driving three small brads with heads three eighths of an inch thick, two at the top and one at the bottom, so as to keep them in place while they were being laid. Then they were grouted with a grout composed of one-half Portland cement and one-half sand, and we thought we had got the very best pavement that we could get. Now, those blocks have not been down over five years and next year they will have to relay those blocks for the reason that the horses' shoes have worn the edges of the blocks, so that instead of being four inches at the top they are one-half that thickness and they are worn down fully three quarters of an inch, and next year they will relay that pavement properly with asphalt on a concrete foundation. The cost of that pavement, a good block pavement, was $3.25 per square yard.

Mr. Cappelen: I believe there is one fact regarding defects of wooden pavements that we must not lose track of, that is the matter of repairing. There is no wooden pavement that will not wear down and wear down uneven. If you have got a bad spot you have got to repair it and you have not got the dimensions of your blocks—you have got to get them to fit—and it is practically impossible to keep a wooden pavement in good repair. Talk about the European wooden pavement in Paris and London, they are built as well as money can make them. They cost about $4 a yard and they are supposed to be removed when they wear down and become rough. It is probably the most expensive pavement in the world. In Australia, according to the reports from the United States Consul in Sydney, they use the Australian woods, which we know are the best for street paving purposes. They have had one street down eleven years and the surface became so uneven from wear, not from settling—the foundation was all right—that they took the blocks up and recut them with machines, sawed three quarters to one half of an inch off at the cost of fifty cents a yard for resawing and made a very good pavement, but that would be out of question in America—to import Australian wood and put it down here. And if the city of Indianapolis can afford to remove it as soon as it becomes rough, as most wooden pavements do after a short time, of course Indianapolis will have the finest pavement in the world, but she will pay the most money for it of any pavement laid.

Mr. Lewis: I do not believe there is a wood in this country which can be used for street paving purposes unless it is treated. The woods which have been treated, that is, the square blocks, such as the old Nicholson pavements, have been failures in the East. They are all gone. I do not know whether or not it is generally known that there is one piece of Australian wood pavement in this country. It was laid for one block on Twentieth street in New York, early this year, by a company whose name I have forgotten. They used what is known as the Karri wood, and it was laid without expense to the city. The superintendent of the work told me that it cost about $4 a yard. It was laid very carefully and it is certainly an ideal pavement now for driving or riding over with a bicycle. It is a block about 400 feet in length only.

The wood pavements, as I understand them, in Europe are a very expensive luxury, but they are willing to pay for the luxury in order to have a quiet pavement. The noise of the horse's feet is scarcely not noticeable, as on an asphalt pavement. As to the cost, I am absolutely sure of my figures, but I think that in the city of Birmingham or Manchester these pavements are laid under a contract without guarantee. The cost is about $4 a yard, and I believe they are maintained for one or possibly two years. The cost of the maintenance from that time on is quoted as being from sixteen to eighteen cents per square yard per annum on streets without tramways or railway tracks, and from twenty to twenty-four cents per square yard per annum on streets that have tracks in them. The life of the pavement in Birmingham and Manchester is very much greater than in London. The London people, however, are willing to pay what to us would seem an enormous price for the sake of quiet and comfort. The wood pavement in London is considered less slippery under almost any conditions, than the asphalt, but as between asphalt and granite in dry weather granite is most slippery and wood the least slippery; the asphalt is between the two. These are conclusions based upon data obtained by Mr. Wm. Haywood. His observations were extensive, running over fifty days, including all sorts of weather. As to the wood pavement in Australia, I have always looked upon that consular report as a little fishy. I remember some of the figures given of a pavement laid in

Sydney where, under enormously heavy street traffic, the pavement showed after seven or eight years a wear of about three-quarters of an inch. They first laid the blocks with open joints which were filled with gravel. They afterwards found it best to lay them just as close together as possible. The blocks on Twentieth street, to which I referred, are laid as closely together as they possibly can be placed, and they are also dipped in tar before being laid, a space of one inch being left next to the curb on either side, which was filled with gravel and pitch.

Mr. Jones, Toronto: I just wanted to give the gentlemen some idea of our experiences with cedar blocks. I think it was in 1881 we wanted to adopt in Toronto a good and cheap pavement. Delegations from our Council were sent through the United States and we unfortunately adopted a street pavement, I think, that we saw put down in Detroit. We have to-day 125 miles of the worst pavement in the city, and perhaps on the continent, through the fact of putting down cedar as a pavement. I have heard a great deal said this evening about the preparation of wood. We tried some time since to preserve our wood and put it on a concrete foundation, filling it in with a Portland cement grout, one of cement to three of sand. We thought that this would give a good, lasting pavement. I think it has been down about three years and it shows very great signs of wear to-day, in fact it is so badly worn that I had to repair it in the last week. We have tried a wood preservative, but, as a member said this evening, the process of creosoting or this tumbling of the cedar block, or any wood, into creosote with the sap in the wood, it has convinced me at any rate, helps to rot the wood instead of preserving it. Nothing, in my opinion, will make wood last as a paving material unless the process that the previous speaker referred to, viz., taking all the sap out and then forcing the creosote in by some process, perhaps hydraulic pressure, would be the best.

I put down three years ago a tamarack on one side of the street where there were street car tracks, a tamarack block treated with what is called a preservative—it is largely lime—and on the other side I put down cedar blocks treated in oil extracted from coal tar, just as an experiment to see which would be the best for the purpose. Both pieces to-day are in neat repair, they have only been down three years in a moderate travel.

I trust that this convention will not go back and advocate the construction of wood for road purposes in this country again. I am satisfied from our past experience, although our country perhaps is better situated for this particular material than any other city in the world for the construction of cedar roadways, on account of facility of procuring supply of this paving material, I am satisfied that our Council, at any rate, will not adopt them again. We can construct cedar block to-day upon a sand foundation at about 65 cents per cubic yard. It is the cheapest roadway we can make, but it is not a lasting one, and our experience has been that it does not wear out upon the residental streets, of which Toronto has nearly a hundred and twenty-five miles. The blocks originally were put down seven inches and you can take them up to-day and they tumble all to pieces with dry rot. My experience with cedar has been in our country that, with heavy traffic on it, it will wear and not rot. I am taking up to-day blocks in street railway tracks that were only put down four years ago, that were down to an inch and three quarters; they were originally put down six inches. That is on a concrete foundation too, filled with a Portland cement grout. We thought it would give better wearing qualities than that, and we found our mistake, and I trust we will adopt something better than any kind of wood for our roads in the future.

THE PRESIDENT: I would ask Mr. Lewis whether he can give us any information upon the practice followed and the restrictions placed by Brooklyn in opening permanent paved streets. I understand that they have taken restrictive measures there of late.

MR. LEWIS: I wanted to touch upon that subject, but I do not want to talk too much. There is not anything which has caused us more trouble and anxiety than the outrageous abuse of new pavements by constant openings. One block which was paved in Brooklyn six weeks ago at the expense of the city at large without assessments upon the property owners, had made in it, within three weeks, eight large openings. I refused to approve the permit when the first application was made, but was subsequently compelled to do so, as the owner's water supply was entirely cut off for lack of repair, although notices had been left at every house on that block two months before the paving was done directing these people to make all necessary repairs to their water, sewer and gas connections. They paid no attention to them. They were paying no assessment and did not seem to care. So far as corporations are concerned, we are empowered now to make necessary rules to check these abuses and the Common Council has passed an ordinance directing that notices be sent to every corporation having subways or construction of any kind in the streets about to be repaved within fifteen days of the commencement of work, and directing them to make any repairs or reconstruction necessary. The issuing of permits to open the street is then prohibited for any repairs except those that are obviously and imperatively necessary for a period of five years in the case of an asphalt or a brick pavement, or three years in the case of a stone pavement. This does not get at the bottom of the matter at all. What we want is to check the openings, the private openings, and the only way that we can do that is to have power given us to enforce absolutely the repairs to pipes or the connections before the street is paved, and to insist that connections in front of unimproved property are carried to the curb line. We hope to get legislation next year giving the Department of City Works authority in this matter so that they can, if the property owner declines to make his repairs, or put in his connections in front of the vacant property, do the work and make the cost thereof a lien upon the property and include it in the assessment. The custom in the past has been to charge $7 for a permit for a water and gas connection, and $10 for sewer connection. In case of pavements under guarantee we have compelled the plumber to bring the written consent of the guaranteeing contractor, or we will issue no permit.

There have been vigorous protests on the part of the plumbers against putting this power into the hands of the contractor, but we have found this plan more effective in securing the proper refilling of trenches than any inspection that we can make. I have very little confidence in inspection in such cases, for I believe it is impossible for any inspector to insure the proper filling of a trench to the same degree as it can be insured by making the contractor or the party who opens the street understand that he is absolutely responsible for any settlement and that such settlement will be a costly matter. Since the first of October our scale of prices has been materially changed and the plan of repairing these pavements was modified. We insist now that in all openings in asphalt or brick pavements, no matter whether the asphalt is laid over old cobble-stones, as the majority of our asphalt is, and in any pavement having a concrete foundation, that in repairing the pavement eight inches of Portland cement concrete shall in every case be used. We charge for all openings—water, sewer or gas connections—$13 during the time between the first of March and the first of December and $18 from December 1 to March 1. We make no money on this work except as we pay our contractor $12 for each opening and the other dollar is to cover the cost of inspection. During the extra $5 is something of a compensation for the inevitable delay in repaving and also to cover the increased cost due to the enlargement of the opening during the months that it may be left open. The regulations in force in different cities are, by admission of municipal officers, entirely inadequate to secure the desired results. I have noted down here a few replies to letters sent by me to different municipal officers which will illustrate this fact. Some of them seem to control the matter pretty well, but most of them do not. These letters were received over a year ago and I may, perhaps, be doing some of these cities an injustice in reading them now, because they may have changed their methods. The replies are as follows:

REGULATIONS IN FORCE IN VARIOUS CITIES GOVERNING THE REFILLING AND REPAVING OVER OPENINGS IN STREETS AS STATED IN REPLY TO QUESTIONS SUBMITTED VARIOUS MUNICIPAL ENGINEERS.

CHICAGO.

"We are contemplating sand back-filling. Require deposit and bond. We only have police powers."

PHILADELPHIA.

Charges for opening streets when paved with sheet asphalt....	$13
" " " " " " " asphalt blocks...	8
" " " " " " " block pavement.	6
" " " " " " " Macadam "	6
" " " " " " " vitrified brick...	3
" " " " " " " cobblestone.....	2
" " " " " unpaved..................	1
" " " " for tunneling....................	1

Water connection $1 additional for driving tap—from Dec. 1st to March 1st $5, in addition to above for all paved streets. No puddling allowed. Rammed in 6" layers. Fine of $50 for violation of ordinances and no permit issued until fine is paid.

ST. LOUIS.

Deposit of $25 for each 75 ft. or fractional part thereof of trench. Work to be done under inspection, and cost thereof charged at rate of 30 cents per hour while inspector is present. Pavement kept in repair for six months. Any work required to be charged to deposit. When deposit is reduced no permits issued until full amount is again made good.

BOSTON.

"Stringent regulations. Some streets cannot be opened for one year, and some for two years, except in case of obvious necessity."

BALTIMORE.

All trenches to be carefully rammed under a penalty of $10 for each offense. Signature of agreement to keep street in good repair over trenches. No restrictions in case of newly laid pavements.

CINCINNATI.

Agreement exacted to restore pavement as many times as necessary. Electric and other shallow trenches are filled with concrete on granite asphalt and brick streets. Street car tracks laid on white oak ties 2½ ft. c. to c. Concrete 6″ below bottom of ties and spaces, between ties filled with concrete to top for granite and brick, and to under side of asphalt pavements.

BUFFALO.

Work done under city inspection in case of individuals and certain corporations. Other corporations having old charter open streets without permission or notification. Subject now under consideration. On newly laid streets individuals or corporations must obtain permit of guaranteeing contractor.

NEW ORLEANS.

Work done by corporations. There seems to be no regulation.

WASHINGTON.

"All excavations are strictly under supervision of the Department. All repairs to permanent pavement are made by the District at expense of parties doing work, who are required to make deposits of amount to cover cost."

DETROIT.

"All filling of trenches done under inspection of Board of Public Works. Amount sufficient to cover cost is deposited with B. P. W. before permit is issued.

MILWAUKEE.

Repaving over trenches done by city at expense of corporation or individual. No permits granted to open newly paved streets if there is possibility of attaining the desired object at any cost in any other manner, except in case of repairs to a break.

NEWARK.

Back filling done by parties making opening. Repaving done by city in case of water, sewer or gas connections. Over trenches for mains, etc., repaving done by corporations under city inspector.

MINNEAPOLIS.

Refilling and repaving done according to directions of City Engineer.

LOUISVILLE.

Work done under permit and inspection of B. of P. W.

OMAHA.

Permits given on condition of a bond or cash deposit to maintain street in good condition for one year.

ROCHESTER.

No system. Sometimes inspection at expense of company doing work. Admitted to be unbusinesslike.

Mr. Burkhardt, Newark, N. J.: We, in Newark, labor under the same difficulty as the gentleman from Brooklyn, that is, after having the street paved nicely, the property owners have proceeded to open the streets. Last year we paved about seventeen miles of street and after it was paved a great many people made these street openings. We took the trouble last year, before we paved the streets, to have notices printed in the daily press, asking property owners in all those streets which we intended to pave, if they had any connection to make, sewer, water, etc., to do it before the street was paved. Some did it, others not. Now, I understand that Trenton, N. J., has a city ordinance which provides that, after a street has been paved, no property owner has a right or can get the privilege of opening the street within seven years from the time the street was paved. Now, if that is the case, I think that is a very good ordinance. I think the matter of opening streets right after they are paved, is one that should have attention. I understand that some cities are trying to get a law whereby the water works or the municipal authorities shall have the power of making all connections, all service pipes to the curb, whether it is a house or a vacant lot, so that the street will not have to be torn open after it is paved, and I think if that could be accomplished that would be the thing to prevent any future opening of streets after nice pavement has been put down. We put down a good many asphalt pavements last year and quite a number of them were torn up three or four months after they were paved and certainly you cannot put back a pavement as well as it was originally, and I think that is the trouble a good many cities have to contend with.

Mr. Frost, Plainfield, N. J.: There is such a law in the State of New Jersey now.

The President: There is in most all States.

Mr. Frost: That provides for the laying of the curb and connection. In the past year the people of Plainfield had it passed purposely.

Mr. Fulton: I just wish to say that, like other cities, we have been troubled with this matter of opening the streets promiscuously and in paving one of our principal thoroughfares this year, the city, when they laid the sewer, made all house connections with every lot to the curb line and assessed that up with the cost of the sewer to the property holder. The water department took some of the money from a bond issue we had, and made water connections also to the curb line. Then our gas companies (we have two of them, one natural gas company and one artificial) agreed to and did lay their pipes to the curb line, and with that regulation we think now that we will be able to hold those streets for at least a year or two.

Mr. Lewis: Did you have the authority to do that?

Mr. Lewis: May I add one remark about the city of New York? That city charges for permits to open asphalt pavements $4.50 per square yard, and will issue no permit for less than four yards or eighteen dollars. They pay the contractor the original contract price and pocket the rest. In case of a granite street laid on concrete they charge $8 for the first yard, and $4 for every additional yard.

Mr. Rundlett, St. Paul: In the City of St. Paul we have authority under our charter, whenever any permanent pavement is laid, which has concrete foundation, to put in the undergroud street connections, under the contract for paving. The Board of Public Works decides what sewer, water and gas connections shall be put in and includes this work in the paving contract. The contractor is responsible for the work after it is done and is obliged to repair the pavement during the time of this guarantee. Any opening that is made in the street after the completion of the work is under city inspection and is paid for by the contractor or corporation who made the opening. The contractor for the asphalt receives ten per cent. additional to the original contract price for making repairs. We find that the system so far has worked very well and by this method we hope to prevent as far as possible the tearing up of paved streets.

MR. DRAKE, Buffalo: I wish to say, if there are any cities in the State of New York that have not already got the permit to require all connections to be laid as far as the curb before paving the street, they are behind the times. The City of Buffalo has had that permit for years and requires it because connections are placed in the streets to the curb and when the gas company furnishes connections on vacant lots, then the party who has paid those taxes for connection can go and get his money back from the gas company.

MR. WHITTEN, South Bend: I just want to say, Mr. President, that it affords me some satisfaction to know that Brooklyn, which is to be a part of greater New York, the metropolis of the United States, is behind Indiana, in that they cannot compel property owners to make connections to the curb of gas, water and sewer. Just a few years ago, at the suggestion of South Bend, the State Legislature passed an act giving cities power in this matter. It affords me some comfort to know that in some of these matters we are fully abreast with those cities who ought to be way ahead of us.

THE PRESIDENT: If there are no further remarks we will close.

MR. RUNDLETT: Before we adjourn I desire to offer an amendment to the constitution.

THE PRESIDENT: Under our by-laws that must be submitted at this time before it can be considered.

MR. RUNDLETT: I offer this as a member of the Finance Committee. It seems probable that our rate of dues as they are now constituted will not be sufficient to publish our proceedings and pay the expenses of making these investigations which are to be made by the different committees and also pay the expenses of our stenographer and other work. It may turn out that we may get through without increasing the dues, and of course the dues cannot be increased this year. But, as the President has stated, any offer of amendment must be made at the first meeting and, therefore, as it may be necessary to increase the dues and in order to bring the matter properly before the Association for discussion, I will offer the following amendment:

"Amend Section 2 of Article 3 of the constitution of the American Society of Municipal Improvements by striking out in the fourth line in said section the word 'three' and substituting the word 'five', so as to read, 'shall pay five dollars per annum for dues'."

THE PRESIDENT: The amendment will be received and laid over under the rules. This amendment suggests my again calling attention to those who have not yet seen the secretary. There are quite a number present who have not yet paid their annual dues. I will find it necessary, gentlemen, so long as I am here, to restrict them privileges granted by the constitution unless these dues are paid. The proceedings will not be sent out. (Applause.) Therefore, I kindly ask you to see that the dues are paid and if all the dues are paid in we need not act upon the amendment submitted this evening. We have to-morrow morning a session commencing at 9:30. I would like to commence it promptly at that hour, as we have two papers carried over from this afternoon and I would like to see the convention adjourned promptly at 12 o'clock, if not a little earlier, so as to give you an opportunity to take lunch before taking the train which leaves at Dearborn Street Station promptly at 1:15.

On motion the meeting adjourned.

THURSDAY, October 15, 1896.

MORNING.

The convention was called to order at 10 A. M. by President Benzenberg.

THE PRESIDENT: The first paper coming up this morning is upon the subject of "Rumbling of Brick Pavements" by Mr. E. Adam, Engineer Board of Street and Water Commissioners, Newark, N. J.

The following paper was then read by Mr. Adam.

SUBJECT UPON THE NOISE OF BRICK PAVEMENTS.

BY ERNEST ADAM, ENGINEER STREET AND SEWER DEPARTMENTS, NEWARK, N. J.

During the past year the Board of Street and Water Commissioners of the city of Newark, N. J.—called the Board of Public Works in other cities—awarded contracts for the paving of five streets with paving brick. It was the first work of the kind ordered in this city.

The brick selected were the Canton re-pressed shale for Congress street, 7,551 sq. yds.; the Canton standard (wire-cut) shale for South Tenth street, 5,940 sq. yds.; the Mack re-pressed fire-clay for Prospect street, 5,247 sq. yds.; the Mack re-pressed, fire-clay, grooved block for Johnson avenue, 8,676 sq. yds.; and the same block for Roseville avenue, 20,000 sq. yds.

The first three streets measure 36 feet between the curbs, Johnson avenue 42 feet, and Roseville avenue, 30, 38 and 45 feet.

The pavement in South Tenth street was commenced Sept. 28th and completed Nov. 13th; Congress street, Oct. 16th and finished Nov. 30th; Johnson avenue, Oct. 21st and finished Dec. 17th; and Prospect street, commenced Nov. 7th and completed Jan. 3d, 1896; the Roseville avenue pavement was not commenced before the month of May, this year.

The specifications for all of these contracts call for a 6-inch concrete foundation, 1½ inches of sand cushion, and Portland cement grout for filling the interstices; the grout to be composed of equal parts of cement and sand.

Although the pavement in South Tenth street and Congress street was not finished until the middle and end of November, yet no frost had affected any of the material, but in the other streets this was not the case; the temperature at times was below freezing point, so that salt had to be used in the cement grout.

In every one of the streets there is a very objectionable rumbling noise when vehicles are run over the pavements; it is not distributed over the entire area, and is more noticeable in hot than in cold weather.

As some of the property owners along the line of these streets made complaints, I began to investigate the cause of this noise, and attempted to find a remedy for it in the pavements already laid. I solicited information upon the subject from a number of Engineers in other cities, where I knew that considerable brick paving had been laid for a number of years.

From information received from this source and my own observations, I came to the conclusion that in order to avoid this objectionable noise, it was necessary to abandon the exclusive use of cement grout. In the city of Brooklyn, N. Y., one of the streets paved with brick and the interstices filled with cement grout, also caused an almost intolerable noise. Mr. N. P. Lewis, Engineer of Street Construction and Maintenance, according to a recently published article, entitled "Trouble With Noisy Brick Pavements in Brooklyn," attributes the cause of the noise to the fact that the paving was done in cold weather, during which the sand cushion and probably the surface of the concrete was frozen at about the time the bricks were rolled. And as the frost worked out it caused the sand and concrete to shrink, producing a void under the bricks, and consequently a noise.

My experience with the brick pavement in South Tenth street and Congress street, where I am positive the frost had not affected any material, contradicts the theory of Mr. Lewis.

In fact, the noise in South Tenth street is greater than in Johnson avenue, where salt was used in the grout. Mr. Lewis also attempted to remedy the evil, but according to the article mentioned he abandoned all efforts, because he found the noise spread over the greater part of the street. Mr. Lewis then tried to crush the paving down with a 15-ton roller, but it was impossible.

There seems to be no doubt that the noise is caused by a void under the bricks, which is produced by certain conditions. This I would principally attribute to expansion.

In the city of Wilmington, Del,. where the same difficulty was experienced in a street paved with brick, the Engineer informed me that a strip of 100 feet in length and 18 inches in width was cut through the center of the pavement, thinking it would relieve the noise, but did not accomplish the desired result.

In Easton, Pa., where I went to make some observations upon brick pavements, I saw a street with an 8 per cent. grade. On account of the steepness of the street, it was considered necessary to fill the interstices near the gutter with cement grout. This was done to the width of four feet from the curb; the balance to the car-track had a sand filling.

Along the entire length of the block, a slight ridge of ½ to ¾ inch in height could be traced along the division line, showing a general settling of that part of the paving in which sand had been used. In fact, a large number of bricks which lapped from one into the other were broken on the division line.

On the brick pavements in Easton, where the joints are filled with paving-mastic or sand, there is no uncommon noise, but the edges of the bricks in some streets are considerably worn off, leaving ¾ to ½ the original surface. This observation and the opinion of other engineers made me come to the conclusion that the durability of a brick pavement would be sacrificed to a great extent if either paving-mastic or sand was used.

The theory of expansion in brick pavements was clearly proven by an ocular demonstration in Johnson avenue, which is paved with fire-clay blocks, as previously stated.

Upon May the 10th, this year, when the temperature was 94° in the shade, the pavement was heaved at a point where the avenue forms a summit; it is said that a loud noise accompanied the rupture. The break formed an arch with a 9-foot span and an 8-inch rise, and extended from curb to curb, 42 feet.

The lateral expansion could be traced along the curb line for a distance of 120 feet in one direction to a street intersection, and for 200 feet in the opposite one; the cement grout was loosened from the curb. The pressure was so great that a number of the bricks were broken, which had been forced out of place, and many showed a horizontal rupture. The difference in the measurement over the top of the arch and its span was .07 of a foot.

In Carnegie's Hand-book for 1893, on page 190, is given a table of linear expansion of substances by heat; applying the coefficient of expansion given for fire-brick, and calculating the linear expansion by taking the difference of temperature between the time of the rupture and when the pavement was laid at 85° (110°—25°), it singularly produces almost the same result, namely, .081 of a foot.

No rupture like this has occurred in any of the other streets, although there are bulgings, but more so in the fire-clay than in the shale brick pavements.

However, in an article published in the "Engineering Record" of Aug. 15th, this year, it is stated that a similar rupture occurred in one of the streets in Terra Haute, Ind., in which Canton standard shale brick were used, the rupture forming an arch with an 8-inch rise.

As previously stated, the pavement in Roseville avenue was not commenced until the month of May, this year; the experience had with cement grout filling should have caused us to abandon it in this case, but the specifications in the contract, which had been awarded last year, required such a filler.

When three blocks of the avenue had been paved in the ordinary way, a different method was adopted in finishing the remaining blocks. A thin board, 1 inch thick and 5 inches wide, was placed against the curb-stones before the bricks were laid, with small wedges set between the curb and the board, so that it could be removed after the bricks were rolled with a 5-ton steam roller.

It was necessary to fill the ends of the joints next to the curb with cement mortar, in order that the paving-mastic which was afterwards filled in the space left by the board, could not spread. At both ends and in the middle of the block a strip of the pavement across the full width and 15 feet in length was also poured with the composition. The blocks are about 800 feet long.

The mixture was that ordinarily used in improved stone-block pavements.

This devise was adopted in order to provide for the lateral and transverse expansion during hot weather.

The pavement treated in this manner, so far, does not cause any uncommon noise, whereas in the first three blocks it was very soon experienced after the pavement was finished; but not as loud as in the streets which were paved last year.

As the whole work was not completed until the latter part of August, I can not positively state, as yet, whether this method will give satisfactory results; still it is encouraging.

In concluding, I certainly agree that it is far better to lay brick pavements during the summer months than when cold weather is liable to affect the materials.

Mr. E. B. Guthrie, Chief Engineer, Buffalo, N. Y., then read the following paper on "Cost of Repairing Asphalt Pavements":

REPAIRS OF ASPHALT PAVEMENT, BASED ON EXPERIENCE IN BUFFALO, N. Y.

BY E. V. GUTHRIE, BUFFALO, N. Y.

Any kind of pavement, when properly laid, will give its best results when laid on a foundation well drained, compacted, and free from underground work. But in a growing city of to-day the latter presents the most serious problem in maintenance of our pavements, by reason of the many trenches for sewers, water pipes and electric conduits of all kinds, whether made by the municipality, the corporation or the individual. Whether these trenches have preceded or succeeded the pavement, the evil results are the same, unless great care, and more than is ordinarily bestowed upon them, is given to solidly replace the earth and prevent settlement. With asphalt, on account of its flat, smooth surface, the results of settlement are much more apparent to the eye than in other classes of pavement, and for this reason we probably are inclined to keep it in a higher state of repair.

From my own experience, the conclusion is inevitable that the bulk of asphalt repairs is attributable to settlement over trenches, some to the effect of water getting beneath the roadway, and some to errors in surface mixture, which occurred earlier in the experimental period. A classification of repairs might be made as follows, in the order of their magnitude:

First: Improper trenching.
Second: Poor material and workmanship.
Third: Traffic.

Repairs may be classified as follows:
First: Settlement.
Second: Rolls.
Third: Disintegration where the surface separates into "macaroons" or "nodules."
Fourth: Cracks.
Fifth: Gutter painting.
Sixth: Defects along street railway tracks.

The repairs due to settlement over trenches has been referred to as comprising the majority of all repairs, and covers work done by the various plumbers, corporations, contractors and the city itself. If the defect appears within the period for which the individual or corporation is reponsible for its maintenance, they are required to remedy it, otherwise the burden falls upon the city. These repairs are made as occasion requires—to entire pavement, including concrete, or binder and surface, or surface only.

Rolls or ridges sometimes 2 to 3 inches high, and extending frequently from curb to curb, are due, no doubt, to the expansion of the concrete base, though it was a long time before I believed this was the cause. These are sometimes repaired by cutting out entire pavement and replacing the concrete, which is made of natural cement, by broken stone, and re-surfacing; at others by re-surfacing only, though I believe the first is the best method, as the roll otherwise is liable to re-occur. We have this year endeavored to avoid this defect by leaving expansion joints in the concrete, extending from curb to curb and 300 to 500 feet apart, the joints being simply spaces in concrete, in which are placed tar paper, gravel or stone.

Waviness of surface occurs from its movement on the concrete by the action of traffic, and where it exists is greatest on that side of the street having the heaviest traffic. This was more frequent before the binder coat of gravel or fine broken stone and asphaltic cement was used. By borings made this season through the asphalt, at some places where this irregularity appeared, the cause was very apparent from the thin coat at the low points and thick one at the high points.

Disintegration. The breaking up of surface into small rounded pieces often occurs through the action of water which has found its way underneath, coming either from adjoining higher land, or from surface through defective places, especially if there is a railroad track in the street. Repair of this class of defect is made in both ways, cutting out down to the base, or simply renewing top surface, the cementing properties of the asphalt having been destroyed, whatever the cause may be. When repair is made of the surface only, the balance of coating has little more effect than so much sand well compacted, and it is a question if repairs should be made in this way, except on very small patches.

From an examination of streets in 1891, the guarantees of which had almost expired, I made notation of defects, plotted these, and also location of sewer, water and gas mains, with the result that most of the defects followed the lines of said mains and their connections in addition the defects arising from water action generally occurred in places where the soil was clayey, and especially where the abutting land was higher. Since that date we have, where deemed necessary, placed drain tile back of and below the curb, to carry off the sub-soil water, and with good results.

Cracks. This class of defects arise, no doubt, mainly from mixtures unsuited to the climate, lacking bitumen and being too brittle, repairs to which are made by running in asphaltic cement.

Repairs Along Street Railway Tracks. The Railway Company, by its franchise, is required to repair between its tracks and rails and two (2) feet outside of the rails, though it claims by legislative enactment it was exempted from latter requirement on our principal business street. Repairs have been made by the city on this street this season which the Railway Company failed to attend to after notification, and assessment will be levied on the company for the same, with what result is yet to be seen.

The injury to this class of pavement by the Street Railway Company's tracks when not properly laid with tight joints and admitting water will extend, in many cases, to more surface than on any other pavement, and far beyond the two feet specified above.

While on the subject I might say I believe the best results will be obtained with a heavy girder rail, rigidly fastened, and with longer, heavier connections at switches and turn-outs, with concrete under the rails, but not necessarily under the tie, using headers of stone or scoria block, as in Toronto, alternately long and short; if used as stretchers, poor results follow. If the asphalt is carried plumb up to the rail it is impossible to prevent a continuous joint, which will prove injurious. Generally the defects along tracks, laid as they have been in Buffalo, consists in settlement of rail, leaving the asphalt slightly higher, which then is gradually crumbled off by the traffic; if laid with stone next the rail, but not laid "toothing," a rut is formed between the stone and asphalt, to latter's injury, and if laid "toothing," when the Company makes repairs, the stone are removed, with them comes off some of the asphalt, and being done without supervision on part of the city, the chances are it will be laid back by cutting a straight joint, filling the space with stone, and this in time is followed by the rut before referred to. This, and subject of settlement, all points to the conclusion that no individuals or companies should be allowed to disturb the pavement in a municipality. except upon special permit for each and every occasion any work is done to disturb it, and, further, in my judgment, that the repairs to pavement required by such work should be done by the municipal authorities, and paid for by the individual or corporation.

Gutter Painting. The gutters are the weakest part of an asphalt pavement on account of the action of water, and extensive repairs are made, either by cutting out the asphalt when deteriorated to extent warranting this, or by smoothing the surface and covering anew with asphalt richer in bitumen than remainder of surface. I am of the opinion that gutters and curbs made of concrete would be an improvement on those ordinarily made, and hope to learn from other cities their experience with this class of gutters.

Repairs have been made in Buffalo by contracts, each covering a period of one year, those of the current year being upon the specifications attached to these notes. It is essential that repairs be made soon after a defect appears to prevent its increase. When binder is used that the stone forming same, and surface of concrete, are clean and free from moisture, and in cuts that all edges be well covered with asphaltic cement to insure a perfect joint, and the material thoroughly rolled, being left slightly full that a depression may not result. It is our practice to locate and plot all repairs to avoid overlapping, and see that none are paid for which the contractor is obligated to maintain under the three years' guarantee; though this is quite a complex system, there is no other way to locate responsibility, unless a contract is made based on a certain price per square yard of all under city maintenance, or for the city to have its own repair plant, which latter course will probably be the result in cities having large areas of this class of pavement.

The greater proportion of repairs are made by the "skimming" process, in which is used either a heater such as the "Perkins," having a tank for fuel oil and hooded burners, or an open grate on low wheels, in which coke is burned, heating the surface so that it can be raked off, smoothed down if too high, and filled up if too low, in each case with addition of some new material. It has been the custom to permit the use of old material for repairs, the same being heated, new asphalt added thereto, provided the old material has not been injured by heat, though it is questionable whether or not new material should not be required.

The first asphalt pavement laid in Buffalo, other than a small experimental piece at a street intersection, was on Delaware avenue, in 1878, for a distance of 1,990 feet, and covering 9,286 square yards. This way laid by the Columbus Paving Company under management of Mr. N. B. Abbott; it had a broken stone base 8 inches thick, covered with coal tar pitch, upon which was a binder course, 3 inches thick, of sand, gravel and coal tar pitch, then a 2-inch surface of Trinidad asphalt, sand and wax tailings. This street was re-surfaced before expiration of guarantee, was repaired by the property owners about 1890, and was re-surfaced in 1892.

Franklin street was laid in 1879 by the Buffalo Abbott Paving Company for a distance of 2,043 feet, covering 7,264 square yards, and similar in character to preceding, except that the stone base was 6 inches thick, and coarser sand and lime-stone was used in surface. This street in the eleven years of city maintenance has been repaired to the extent of $2,827.82, equal to $.035 per square yard per annum, and in a year or two will probably require re-surfacing. It has been subjected to a large amount of light traffic, and being an old residential street has not been torn up so much for underground work as many others, and presents the best example of a street worn mainly by traffic.

The growth of this class of pavements in Buffalo has been such that there were on Jan. 1st, 1896, the following quantities, and repairs for 1895 and the eleven years of city maintenance, 1885 to 1895, inclusive, were made to the extent shown:

Jan. 1st, 1896—

Miles of asphalt, exclusive of parkways	192.9
Total square yards laid	3,581,238
" " " under guarantee	2,123,168
" " " maintained by city	1,384,418
" " " " " St. R. R.	73,652
Total first cost of pavement	$10,636,157.92

Construction—1896, to Oct. 1st:

Miles	5.22
Square yards	89,163
Cost	$261,360

Repairs—

	Total Cost.	Maintained by City. Sq. Yds.	Cost. per Yd.	On Streets Repaired. Sq. Yds.	Cost. per Yd.	Actually Repaired. Sq. Yds.	Cost. per Yd.
1895	$69,661.49	1,042,543	.067	795,313	.087	57,068	1.22
'85 to '95 inc.	184,349.09	*3,339,558	.055	*2,325,239	.079	134,327	1.37

Repairs—1885-1895, inclusive, at periods 1 to 11 years after expiration of guarantee:

Period.	No. of Streets.		On Streets Repaired.		On Total Maintenance.	
	Paved.	Repvd.	Sq. Yds.	Cost per Yd.	Sq. Yds.	Cost per Yd.
1 year	132	44	528,923	.035	1,057,025	.018
2 years	92	56	587,267	.086	807,692	.062
3 "	73	56	503,730	.085	606,024	.071

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*These are in equivalent yards per annum.

Period.	No. of Streets. Paved.	No. of Streets. Repvd.	On Streets Repaired. Sq. Yds.	On Streets Repaired. Cost per Yd.	On Total Maintenance, Sq. Yds.	On Total Maintenance, Cost per Yd.
4 "	51	37	329,218	.136	403,550	.108
5 "	24	17	145,591	.114	200,179	.083
6 "	9	6	54,000	.063	89,761	.038
7 "	9	8	88,779	.057	89,761	.056
8 "	6	5	44,660	.034	53,946	.028
9 "	3	2	16,140	.019	28,445	.011
10 "	2	2	10,283	.061	10,283	.061
11 "	1	1	7,264	.046	7,264	.046
Average per yard, per annum...............				.079		.055

Prices paid for repairing asphalt pavements:

	1891.	1892.	1893.	1894.	1895.	1896.
Resurfacing per sq. yd...............	1.29	1.62	1.59	1.54	1.49	1.35
Skimming..........................					.99	.88
Replacing base and surface...........	2.35	2.47	2.44	2.39	2.37	2.25
Scraping joints and painting gutters, per lin. ft........................	.04	.04	.04	.04	.04	.03½
Cleaning and pouring cracks, per lin. ft.	.02	.02	.02	.02	.02	.02
Replacing stone toothing along St. Ry. tracks, per lin. ft....					.19	.17

While the streets have been under charge of contractors, the guarantee having been uniformly 5 years, except on streets paved in 1884, where it was extended to 8 years, repairs have mainly been attended to where and to such extent as they were found necessary without necessity of demand from authorities. This is not the proper way, for the authorities are not enabled to study each pavement and get data for avoiding similar defects.

Upon the expiration of guarantee the streets are placed in thorough repair under supervision of inspectors, in some cases to the extent of resurfacing entire street. The maintenance guarantee, as ordinarily drawn, is not specific enough, leaving too much to the discretion of the authorities, and I believe it should be for a longer time, state as closely as possible what kind and to what extent repairs should be made by patches, filling, skimming, or when to be resurfaced.

Furthermore, an inspector should be placed at the plant of paving contractor, to know what course is pursued there, otherwise the municipality has no data for study of various mixtures, nor does it know that the contractor is carrying out the specifications in this important feature.

EDWARD B. GUTHRIE.

Oct. 14, 1896.

SPECIFICATIONS.

For the repairs during the year 1896 of all pavements on the streets of the city of Buffalo paved with asphalt, except those upon which the guarantee for maintenance has not expired.

EXTENT OF REPAIRS.

The repair of wearing surface, cushion coat and concrete base shall be made to such an extent as is directed by the Chief Engineer or his representative.

In every case any and all defects, such as ruts, cracks, depressions, holes, etc., are to be remedied and repaired as directed by the Chief Engineer or his representative, and any asphalt pavement taken up for sewer, water or gas service or other underground structure will be considered under the head of repairs, and the contractor will be required to replace such pavement when so directed by the Chief Engineer.

CONCRETE.

When it is necessary to replace the concrete base, the base thus replaced must be six (6) inches in thickness and composed of one part of the best freshly burned hydraulic cement equal to the best Rosendale cement, and two parts of sharp, clean and coarse washed sand free from clay or vegetable matter, and five (5) parts clean broken stone, all by measure.

No stone to be used from old concrete unless free from the cement originally mixed therewith, and then not, except by direction of the Chief Engineer, or his representative. The sand and the cement to be thoroughly mixed dry, and then water shall be added in sufficient amount to make a stiff mortar. The broken stone to be wet, then added to the mortar and the whole thoroughly mixed by means of hoes and shovels.

FOUNDATION.

Should the earth under the concrete to be replaced be soft and spongy and not affording a firm foundation it must be dug out and replaced with broken stone or loam well rammed.

BINDER.

The second or binder course will be placed on the concrete base and consist of a concrete made of clean broken stone or gravel not exceeding one and one-half (1½) inches in their largest dimension, thoroughly screened, and coal tar residuum commonly known as No. 4 paving composition, or its equivalent of asphaltic cement. The gravel, stone and paving composition will be heated by passing through revolving heaters and thoroughly mixed by machinery, with the paving composition in the proportion of one gallon of paving composition or asphaltic cement to one cubic foot of stone. The binder will be hauled to the work while hot, carefully spread on the base with hot iron rakes to such a depth that the least thickness for the topping or wearing surface will be 1½ inches when the sum of the topping and binder is not over two (2) inches. As this sum increases the thickness of the topping will be increased until it attains a depth of two (2) inches. Beyond this the thickness of the binder may be increased. When the topping has slid on the concrete the contractor must roughen the latter by means of picks or bars in addition to the binder.

PAVEMENT PROPER.

Upon the binder course shall be laid the pavement proper, in accordance with the requirements given below.

WORKMANSHIP.

The general repair to the wearing surface will be of two kinds:

First: When it is necessary to cut out the asphalt to the concrete.

Second: Skimming.

All repairs to the asphalt must be made with the same kind of composition or kind of asphalt as the pavement, and laid so as to bring the surface even with the adjoining pavement, making a close, smooth joint therewith without any cracks, depressions or elevations, and to conform to the contour of the pavement. The pavement to be cut so as to make a bevelled joint of the old and new material, and all joints are to be painted with pure hot asphalt before new material is laid. The repairs are to be so made that at the completion of each day's work no holes cut out for repairs shall be left unfilled or unfinished. The holes must be perfectly dry and no material is to be laid during a rain.

SKIMMING.

Skimming will be done as directed by the Chief Engineer. The contractor will heat the asphalt by means of a heater made for the purpose, so as to be able to scrape off the defective surface to a depth sufficient to make the finished patch conform with the contour of the street.

OLD MATERIAL.

All old material, dirt, asphalt, concrete, etc., broken up, is to be the property of the contractor and to be removed promptly from the street by him. The company must keep all of the patches clean and in such condition that they can be easily found and measured, and assist the Engineer in locating patches when necessary.

REPAIR ALONG STREET RAILROAD.

Where repairs are to be made along street railroad tracks, the stones are to be laid as headers, alternately long and short, making a toothing to be laid in concrete of composition described below. The joints to be paved with a mixture of coal-tar distillate known as No. 4 paving composition, and gravel to a depth of 5 inches, and made watertight. Any new stone necessary in the opinion of the Chief Engineer, or his representative, are to be Medina sandstone blocks, 3½ to 4½ inches thick and 7½ inches deep, and are to be furnished by the contractor.

MEASUREMENTS.

Will be made by a superficial measure as near as can be reduced to a straight line measurement, and the work paid for at a certain price per square yard:

A. For resurfacing (by which the entire asphalt surface is to be taken out to the concrete and is to include all work necessary except the repair of the concrete) per square yard.

B. For skimming, where only part of the wearing surface is removed and replaced with new material, per square yard.

C. For replacing concrete and asphalt surface (including removing and replacing spongy earth where necessary) per square yard.

D. For scraping joints between curb and pavement and for coating gutters twelve (12) inches wide with pure hot asphalt and smoothing with hot smoothing irons, per lineal foot.

E. For cleaning out cracks, pouring them with pure hot asphalt and smoothing with hot smoothing irons, per lineal foot.

F. For replacing stone along street railroad tracks, between tracks and asphalt pavement, with concrete base, and pouring joints of same with bitumen and making the asphalt connection between stone and asphalt pavement, per lineal foot.

GENERAL SPECIFICATIONS.

Payment will be made upon vouchers upon the proper form by the contractor.

The asphalt cushion and wearing coat will be replaced in compliance with the following conditions. (See printed form.)

The contractor will be required to furnish a bond to the city of Buffalo for $15,000 with two sufficient sureties, who shall each justify in the full penalty of the bond, the conditions of said bond to be that the contractor will maintain and keep in repair any repairs made under this contract for the period of three (3) years at his own expense, and in the extent of the contractor refusing to make such repairs within five (5) days after a written notice from the Chief Engineer, then the sureties on said bond will be notified and directed to proceed with the repairs as directed by the Chief Engineer. This refers only to the case where it is evident that the defective pavement is a patch under guarantee. In cases where only a comparison of measurements can be determined that the new patch includes or overlaps one under guarantee, the Asphalt Company whose guarantee patch has been replaced will be responsible for the number of yards replaced, and will in all cases abide by the measurement of the Chief Engineer.

THE PRESIDENT: Gentlemen, I have just received the paper which was to have been read yesterday afternoon, prepared by Mr. A. W. Dow, of Washington, upon specification requirements for asphaltic mixtures and tests for the same. The paper seems to be a very complete review of the entire subject, going into it apparently with considerable detail. The paper is quite a lengthy one and unless a demand for the reading of the paper is made I will merely pass it over, have it read by its title and printed in the proceedings.

It was moved by Mr. Stainsby that the paper be received and printed with the proceedings. Carried.

SPECIFICATIONS FOR ASPHALTIC MIXTURES AND TESTS FOR SAME.

BY A. W. DOW, WASHINGTON, D. C.

The request is frequently being made for a knowledge of the methods by which an asphalt suitable for street paving may be distinguished, and for a practical set of specifications for an asphalt mixture. Little has been written, and but little is known, but the enormous increase in paving streets with asphalt throughout this country in the last five years has made the subject one of general interest. In my effort to throw a little light on this subject, I am hampered by the thought that practically everything is in the crude state of a beginning, and that no standards have as yet been fixed for any tests.

As there is at present some confusion as to the meaning of certain terms used in this article, I feel it advisable to define this meaning as employed here.

Bitumen—Any and all hydrocarbons, whether natural or artificial, soluble in carbon di sulphide.

Asphaltum—A natural bitumen, all or a portion of which is insoluble in petroleum naphtha, and in most cases found associated with various mineral and organic substances.

Asphalt—Any and all natural deposits containing asphaltum.

Asphalt Cement—An asphalt or allied substance softened by some softening agent; or an asphalt of the proper consistency for use in paving. It may be more or less pure.

A properly constructed pavement should be composed of the three (3) parts, base, binder, and wearing surface.

Base—As in all pavements, the base should be given the closest attention. It is false economy to try to save on the base. It is well in the constructing of a pavement to consider that the base is the true pavement, and there is no reason why it should ever be reconstructed. The wearing surface is intended to take the wear and tear of traffic and can be replaced on the same base, times innumerable. It should be made of concrete of at least six (6) inches in depth, on a well compacted bed, unless it should be desirable to lay a wearing surface on an old stone or macadam pavement. It is not, however, advisable to remove a stone pavement, lower the grade, replace the stones, and then lay on the wearing surface, as it is impractical to relay the stone pavement with sufficient care to prevent parts of it from compacting more than others, which will in time produce depressions in the wearing surface.

Binder—As the surface of the base is comparatively smooth, and of such a character that the wearing surface would have no bond with it, it is found necessary to use what is called a binder. This binder, as the name implies, is intended to bind the surface coat to the base, thus preventing it from shoving under traffic in warm weather, while in a soft condition. It should be composed of angularly broken stone of varying sizes, mixed with soft asphalt cement.

Wearing Surface—It should be composed of a sharp-grained sand containing some dust, and an asphaltic bitumen. Too little importance, in the past, has been paid to the selection of the sand and dust for asphaltic mixtures, and many failures have resulted therefrom, which were considered due to other causes. I would not be far from right in saying that it is possible by varying the grade of sand, and the quantity of dust, to produce any character of pavement desired, without changing the bitumen. Indeed, the sand and dust are of as much importance in the making of a good pavement as the asphalt. In selecting a sand, certain rules should be observed. It should be moderately fine, the grains varying in size from coarse to fine, the fine predominating. A good sand on sifting should give proportions somewhat similar to these:

Retained on	10	mesh per inch sieve	0%
"	20	" " " "	12%
"	40	" " " "	25%
"	60	" " " "	20%
"	80	" " " "	10%
"	100	" " " "	18%
Passing through	100	" " " "	15%

All the grains retained on sixty (60) mesh sieve must be hard, as it is desirable that they resist being crushed by traffic. This is very important, and a number of pavements have failed for no other reason than that the coarse grains were crushed, producing numerous small grains that were uncoated by bitumen. A proper grading of the sand from coarse to fine with considerable fine is desirable, as it permits the use of more, and a softer bitumen. To understand the desirability of this, it is well to remember that all bitumens harden by the fall of temperature, and that at some low degree they tend to be more or less brittle. If, now, so fine a sand be employed that the bitumen used may be so soft that the degree of temperature at which it would become brittle is below the minimum of atmospheric temperature, we can prevent our pavement from becoming brittle.

A round-grained sand is to be avoided as it produces a much softer mixture than an angularly-grained sand would, though the same bitumen be used with both. It is but seldom that a properly graded sand is found, and especially one containing the requisite quantity of fine. To overcome this difficulty, two (2) or even more sands are often mixed, and more often some suitable dust is mixed with it. This dust should be any inorganic substance unaffected by water. In the selection of a sand for a mixture, the earthy matter of the asphalt cement must be considered as a part of the sand.

Bitumen—Bitumen may be derived from various sources, as, a suitable mixture of a hard and soft asphalt, a hard asphalt with an asphaltic oil, from an asphalt found naturally to contain a bitumen of proper consistency, or, a hard asphalt softened with an artificial product. As there are practically no artificial bitumens used alone in street paving, I will only deal with those derived from natural origin, and of mixtures of natural and manufactured products.

The necessary characteristics for a bitumen to possess are adhesiveness, cohesiveness, and elasticity to a certain degree. It must not show too rapid a change with ageing; must be practically unaffected by water or dilute ammonia; and have a proper degree of consistency or softness. Its consistency should not be greatly altered by changes in temperature; and, lastly, a certin degree of stability upon being kept at a high temperature for a length of time.

If in the examination of an asphalt, or like substance, to determine its suitability for paving, one finds that the bitumen contains the above properties, it will be safe to say that it will make a good pavement, if properly manipulated.

METHODS EMPLOYED IN THE EXAMINATION OF ASPHALT CEMENTS.

Determination of per cent. bitumen, foreign organic, and inorganic residue. The per cent. bitumen in a substance is determined by extracting it with a solvent, generally carbon di sulphide. This extraction may be done in numerous ways. The method that I have found to give the least trouble, and require the least experience, is by extracting in large test tubes, or cylinders, decanting off the solvent containing the dissolved bitumen from the insoluble portions.

The method of procedure is as follows: The asphalt, or like substance, is spread in a thin layer, in a suitable dish (nickle or iron will do) and kept at a temperature of 225° F. until it practically stops losing in weight. The greater part, and in some cases, all the water, and some light oils, are expelled in this way. From two (2) to ten (10) grains, (depending on its richness in bitumen) of this substance is weighed in a large-size test tube (8″ long by 1½″ diameter), the tare of which has been previously ascertained. The tube, containing the substance, is then filled to within 1½ inches of the top with carbon di sulphide, and allowed to stand for a few minutes; then the tube is tightly corked with a good sound cork. It is then shaken vigorously until no asphalt can be seen adhering to the bottom. Care should be taken while shaking to keep one finger on the cork to prevent its being blown out. The tube should then be put away in an upright position and not disturbed in the slightest way for two (2) days, after which the carbon di sulphide is decanted off into a small bottle. As much of the solvent should be poured off as is possible without losing any of the residue. The tube is again filled, shaken as before, and put away for two (2) more days. After the liquid has been carefully decanted the second time, the tube, with the residue, is dried at a low temperature, and then at 225° F. After cooling it is weighed. As there is always a small portion of the residue poured off in the solution with the bitumen, this solution must be evaporated and the bitumen burned off in a plantinum dish, and the weight of the residue added to that in the tube. The weight of the substance taken, less the sum of these two (2) weights, is the weight of the bitumen extracted, from which can be calculated the per cent. bitumen.

The determination of the organic matter, not bitumen, is made by burning, in a tared platinum crubible, the residue left in the tube after extracting the bitumen. The loss on burning is the organic matter not bitumen, or, as it is often called, the foreign organic matter, 100%, less the sum of the foreign organic matter, and bitumen per cent. is the inorganic matter.

The softness or consistency of a bitumen, or asphalt cement, is determined by an apparatus devised by Prof. Bowen, which is generally spoken of as a penetration machine. This piece of apparatus has been described several times in print, and is patented, so I will not enter into any details as to its construction. This determination is made, by ascertaining the distance, registered in degrees on a dial, that a needle will penetrate into a bitumen in a fixed time and under a fixed weight. The penetration of a sample is taken by lowering the needle, until it is just in contact with the surface. A clamp is then released, which allows the needle to penetrate into the sample for any fixed time (one second being the time generally allowed). At the end of this time, the clamp is closed, and the degree of penetration noted from the dial. All samples must be kept at a standard temperature for at least half an hour before making the test. This is most accurately done by keeping the machine and samples in a small room kept at the standard temperature.

Susceptibility to Change in Temperature—This is determined by taking the penetration of the substance, at several different degrees of temperature, and noting its variation caused by the rise or fall.

Change Due to Age—All bitumens undergo a more or less rapid change with ageing, that appears to be due to two or possibly more causes. Two distinct changes manifest themselves. One is the surface hardening which is likely due to indirect oxidation, and, possibly, to the volatilization of light oils. It begins at the surface and gradually extends into the bitumen. The other is a hardening of the entire mass evidently due to polymerization. Both these changes take place in all bitumens, but one or the other may predominate. The former is much the less objectionable, as it makes but slow progress into the mass. It is preferable that this test be made on the asphalt cement, as there is some danger in using extracted bitumen of the solvent not having been entirely removed, and its slow evaporation might be interpreted as a true change, due to the hardening of the bitumen.

This test is made as follows:

The penetration of the sample is determined, after which it is put away for a week, when it is again ascertained. If the sample has been found to have appreciably hardened, a slanting cut is made into it with a keen, sharp knife, laying over the upper piece, thus exposing a gradual descent from the surface into the interior of the cement. Penetrations are now taken down the side of this cut, beginning at the surface. In this way, the increase in hardness of the surface and the interior over its original consistency is determined; also, the hardening of the surface over the interior, and the depth that the surface hardening has entered the sample.

It is well to continue this test for as a long period of time as possible, making examinations at intervals of every few weeks.

Its stability upon being kept at a high temperature for a length of time—The necessity of this stability is owing to the length of time the bitumen must remain in a heated condition, during the course of the manufacture of the asphalt mixture, which, however, may cause it to lose valuable properties. The effect of this heat is rendered much more severe on the bitumen, because of its great area exposed to evaporation when mixed with sand.

The lack of stability, resulting from the loss of light oils, is manifest, in different ways, in different bitumens. Although generally so, it does not of necessity follow that the bitumen losing the most oil undergoes the greatest change in consistency. There are two methods of determining this, and it is advisable to use both. The first consists in making the asphalt cement into a mixture with a standard sand. This is done by mixing sand and the asphalt cement in such proportions that the mixture will contain ten per cent. of bitumen. This is done by keeping in a hot oven for fifteen minutes at 300° F. and then incorporating by stirring the sand and asphalt. One portion of this mixture is then put aside to cool, while the other is kept at the temperature of 300° F. for one half hour longer. The bitumen is then extracted from both, and, after having arrived at the same temperature, their penetrations are compared.

The second, method consists in keeping a quantity of the substance, equivalent to twenty grams of bitumen, at the temperature of 400° F. for thirty hours. The method of procedure is as follows: The substance is weighed in a short-necked, tubulated, two-ounce retort, the tare of which has been previously taken. The retort is then hung in a copper cylinder so that the neck just protrudes. The copper cylinder is jacketed with asbestos, and provided with a thermometer. After being heated up to 400° F., at which temperature it is kept for thirty hours, the retort is allowed to cool, then weighed, and the per cent. loss ascertained. The retort is then broken open, and the character of its contents compared with that of the original substance.

The action of water and dilute ammonia on an asphalt mixture is determined by moulding an inch cube of the mixture under a pressure of 1,000 lbs. The cube is broken in two, one portion being placed in water, or dilute ammonia, while the other portion is kept in air. The two pieces are compared from time to time. If it be acted upon by the liquid, the corners will be found to give way readily with a slight pressure of the finger. After soaking some time, it is well to evaporate the liquid to dryness, and note if any bituminous residue remains.

Adhesiveness, Cohesiveness and Elasticity—No method has as yet proved satisfactory for the determination of these, other than the sense of feeling, along with experience.

Extraction of Bitumen for the Purpose of Examination—The method which I employ (extraction by subsidation) is the same as employed for the determination of per cent. bitumen, only on a larger scale; and no accurate weighings are necessary. Any method is applicable that will extract all the bitumen in a reasonably pure state. Sufficient of the material to give 20 grams of pure bitumen is put in a large glass cylinder, and extracted with carbon di sulphide, as before described. The solvent containing the bitumen is evaporated off in a clean metal dish, at a low temperature, until it is quite free from the solvent. It is then heated cautiously to 300° F., at which temperature it is kept for 10 minutes. This is necessary, as the last tract of solvent is very hard to remove.

As in the examination of all materials to fullfil certain purposes, some standard must be fixed. In the case of bitumens, the knowledge is too limited, and the methods too incomplete, to fix numerical standards for the various tests; so it is necessary to establish for a standard the bitumen of some well-known asphalt cement. The bitumen generally taken as a standard is that of an asphalt cement, composed of the best quality of Trinidad asphalt, softened with petroleum residuum.

In the examination of asphalts or like products, to determine their suitability for paving, it is necessary that both the hard and softening material be examined, unless the asphalt be already of the right consistency. My method of procedure is as follows:

The materials are mixed together by heating in such proportions as would give a cement of the proper consistency, which is determined by its penetration. All tests are then made on this cement, or the bitumen extracted from it; except where the softening agent employed is injurious, when it must be examined and its quantity limited. I refer here especially to petroleum residuum, which is used for softening asphalts. I have made a careful study of this, and am thoroughly convinced that the use of all petroleum residuum is injurious, some much more so than others. That it is not adaptable, either chemically or physically, to this use, can be readily seen by looking into its properties. With a change of but a few degrees of temperature, it passes from a liquid to a solid state. On standing for a month or two, a hardening sets in, due either to polymerization, or slow crystallization, which makes it even more susceptible to change in temperature. I am also led to believe, from various experiments, that many asphalts are not entirely soluble in petroleum residuum, and for that reason asphalt cement, in which it is used, is not a chemical, but merely a mechanical mixture, or emulsion of the asphalt and the oil. From this it can readily be seen that the undesirable properties of the petroleum residuum are imparted to the asphalt cement to a degree proportional to the quantity of the residuum used. I have found that the best petroleum residuums comply with the following tests:

Specific gravity ranging between 20° and 23° Baume.

The flash point (as taken in a New York State Board of Health oil tester) between 300° and 425° F.

On keeping at a temperature of 400° F. for 30 hours, as described in the tests on bitumen, it must lose between 2 and 6% of oil. The residue in the retort should be fluid at 75° F., and on cooling should not show a coarse crystallization. The quantity of residuum necessary to soften the asphalt into a cement, containing bitumen whose penetration is 80° (District of Columbia standard), should not be over 33% of the total quantity of bitumen in the asphalt.

It must show only the slightest signs of having been cracked in the course of its manufacture. An oil that has been cracked reveals, on being examined through the microscope, numerous black particles, floating through it. The particles are insoluble in petroleum naphtha, but are soluble in carbon di sulphide, and resemble asphaltine.

In the specifications that I now present in this article, I have tried to cover all excepting the limestone rock asphalts, which are mostly foreign, and are objectionable, on account of the poor foothold they afford for horses.

SPECIFICATIONS FOR ASPHALT WEARING SURFACE.

The wearing surface shall be made of an asphalt mixture complying with the following specification:

The materials that shall be used therefor are:

1. Asphalt cement.
2. Sharp sand.
3. Fine mineral dust.

Asphalt Cement—The asphalt cement must not be inferior in quality to a cement made of the best quality Trinidad asphalt and petroleum residuum. This bitumen must comply with the following requirements: It shall be adhesive, cohesive, and elastic to a certain degree. It must not show too rapid a change with aging. It must be practically unaffected by water or dilute ammonia. Its penetration must be within the range of 50° to 120° (D. C. Standard). The penetration must be governed by the traffic; the range of atmospheric temperature; the susceptibility of the bitumen to change in temperature and the character of the sand. Its consistency should not be greatly altered by change in temperature. Its loss on being kept at 400° F., for 30 hours, must be less than 8%, and its character must be so changed that its penetration is reduced to more than one-quarter of its original.

If petroleum residuum has been used as the softening agent, it must comply with the following requirements:

Specific gravity ranging between 20 and 23 Baume.

The flash point (as taken in a New York State Board of Health oil tester) between 300° and 425° F.

On keeping at a temperature of 400° F., for 30 hours, it must lose between 1½ and 5% of oil. The residue in the retort shall be fluid at 75° F., and on cooling should not show a coarse crystallization. The quantity of residuum necessary to soften the asphalt into a cement containing bitumen, whose penetration is 80° (D. C. Standard), should not be over 33% of the total quantity of bitumen in the asphalt.

Sand—The sand shall be hard grained and sharp. On sifting, it should have at least 15% of material that would be caught on a 40 mesh per inch sieve, 25% of material that will pass an 80 mesh per inch sieve, 10% of which at least must pass a 100 mesh per inch sieve. If the sand to be used does not contain the desired fine material, any mineral dust, unaffected by water, may be used to make up the desired deficiency.

The proportions of materials used will depend upon their character and the traffic on the street; but the percentage of bitumen soluble in carbon di sulphide shall not exceed the limit, 9 to 13%.

In some of the methods of examination, I have merely stated the processes that I have found preferable with the apparatus at my disposal. I am in hopes that this paper will call forth criticisms which will lead to discussion, and so bring forth the ideas and methods of others.

Mr. Adam: I would move that after the regular order of business is finished this morning, if we have time for the paper, that the same be read at that time.

The President: That will be done if there is time.

The papers are now open for discussion.

Mr. A. D. Thompson: I would like to ask Mr. Guthrie how the expansion joint in concrete base is made and how wide they made it?

Mr. Guthrie: I will say that that is experimental only and based on experience in concrete sidewalk where it is found absolutely necessary to leave them; we simply put in an inch board and at the end, say of a day's work, take that out and replace it with sand or gravel and possibly with tar paper, something to give it a chance to expand. It was just done this summer and I do not know what the result will be.

Mr. Thompson: Have you ever left those joints without placing anything in them?

Mr. Guthrie: Yes, I have.

Mr. Adam: What distance apart?

Mr. Guthrie: I say, about 300 to 500 feet.

Mr. Adam: I would like to ask Mr. Guthrie what the nature of those repairs were that were made at the rate of 6¼ cents per square yard. What is the average cost per year, what is the nature of the repairs?

Mr. Guthrie: Well, they were of all kinds. The latter part was almost all done by skimming. That is, the bulk of the repairs. They are usually trenches for water, gas, sewer and all underground work, that have been dug and where the asphalt pavement has settled, more depression than wearing-out or defects.

Mr. Sherrerd, Newark: Buffalo has had such wide experience in the asphalt question, I would like to ask if the cost of repairs on resident asphalt streets due to disintegration of the asphalt was anywhere near the cost due to wear in the business portion, and also if Mr. Guthrie can tell us how high on any one pavement the cost of repairs has been. I know that on Eighth Ave., New York, which has lately been resurfaced, the cost has been there, I think, running as high as 60 cents per square yard in the whole street. The contract is for two years.

Mr. Guthrie: I do not know that I can answer Mr. Sherrerd's question, but I will try. On Franklin street it has been laid seventeen years and the wear on that has been mostly due to traffic. It is seventeen years old and in the residential portion of the city. I should say that very few of the repairs have been due to traffic. I think I can say without contradiction that the bulk of repairs has been due to settlement. Of course, before these streets have been turned over to the city some of them have been repaired extensively by the contractors, especially about 10 years ago, when there was more or less experiment about mixtures, but I do not know as I can answer your question specifically.

Mr. Cappelen, Minneapolis: I would like to ask Mr. Guthrie what he considers asphalt pavement in good repair after the guarantee has expired. We all know the specifications called for streets to be in good repair at the time of the expiration of the guarantee, it may be five or ten years. We have now in Minneapolis some streets expiring under a five year guarantee. All our late work is done under ten year guarantee, and I am really at a loss to say if the street is in good repair. I would like to have Mr. Guthrie tell us what he considers an asphalt pavement in good repair at the expiration of five years, for instance, when he is ready to accept it on those conditions.

MR. GUTHRIE: I will answer that in this way, that, as I stated, that the specification should show just exactly the condition the street should be left in at that time. For instance, that there should be no depressions over a certain amount, I do not care whether you make it two or three inches or half an inch, but see that it is understood distinctly by the city and the contractor. And again, if there should be a certain percentage of the surface injured by cracks, that that street should be taken up and resurfaced. We have gone over that difficulty, one street I had to resurface entirely because it was cracked up. And the small rolls and waviness which I think ought not to be left to the discretion of anyone to say whether it should be accepted or not.

MR. CAPPELEN: Up our way we have got cracks over a few feet on some of our pavements, there are cracks from ⅛ inch in width to ½ inch. What to do with the ½ inch cracks that is very easily explained, cut that out or resurface that portion, but what are you going to do with these hair cracks?

MR. GUTHRIE: I should say if it was broken up to such an extent as you say it should be resurfaced.

MR. CAPPELEN: If you had a cracked surface you would have it repaired?

MR. GUTHRIE: Yes.

MR. CAPPELEN: I am very glad to get this information. I may call upon you as an expert to testify.

MR. MUNRO, Omaha: The skimming or veneering process which is now under dicussion for the repairing of asphalt streets is somewhat of a new process, and in the west we probably have not had as great an amount of experience in the practical workings of this process as compared with some of the representatives from the east in this convention. In Omaha we are in somewhat similar condition as the gentleman from Minneapolis, and that is this: When the guarantee contract expires on the pavement, and the paved street is to be occupied by the city, by what means can you determine whether or not the pavement is in condition to be accepted under this new process for repairing asphalt pavement, and what proportion of the original surface should remain at the expiration of the guarantee to make the same acceptable by the city. Supposing that one-half of the original surface remained at the expiration of the contractor's guarantee and immediately preceding that time the pavement should be veneered or skimmed by this new process, would you consider with the experience that you have had that it should be acceptable, and by what means would you determine that the pavement was not in proper condition if that surface was perfectly smooth, as it certainly would be under the above conditions? In other words with the practical experience that you have had in Buffalo with this process, do you think that it has been demonstrated beyond a doubt that it is a perfectly reliable method and has and will stand the wear of traffic to which it may be subjected? If it is shown by the practical use of this method in cities where it has been adopted, and has stood the wear of traffic the necessary length of time, I say that a pavement so repaired at the expiration of the guarantee contract should be accepted. But if it has not fullfilled those requirements it should not be accepted as a reliable method of repairing asphalt pavements.

MR. GUTHRIE: We have used it about three or four years and so far it has given good results, but as I stated I have my doubts about the use of old material in mixing up with new asphalt to replace those patches or repairs. I think some of these are liable to scale off, but it is not due in my belief to the process of skimming, it is in the nature of the material, it loses its life, the different parts heated to different degrees, I do not think they get the mixture in its proper shape. I would like to know if anybody else has had experience in the way of material once on the street and taken up and used again.

Mr. Munro: In Omaha we have one company which has a contract for keeping in repair asphalt pavements, which contract includes a considerable area of our asphalt paved streets. They have been using this new process for about two years past and we find that on light traffic streets it proves satisfactory, but on heavy traffic streets it does not stand the wear satisfactorily, and on some of our heavy traveled streets they have been repaired once or twice a year while under the old method, under the same condition of traffic, the streets would not have required the same repairing done but once in two or three years. Under this new method the heater or machine is placed immediately over that part of the pavement to be repaired and sufficient heat is produced to disintegrate the old asphalt pavement so that it can be scraped off afterwards the required depth. Now, when sufficient heat is produced to burn the asphalt and disintegrate it you will find that it also burns the life more or less out of the old pavement immediately surrounding the new repairs, for it is an utter impossibility to so confine this heat in such a manner that it will not injure the edges of the surrounding pavement contiguous to the repair. It will not only destroy the surrounding pavement to a greater or less extent, but also the base will be injured on the same conditions. As you will observe on asphalt paved streets where this method is in use that the asphalt wears out and disintegrates more readily at the junction of the old asphalt and repair patch, which goes to show and demonstrates the theory that this portion of the pavement has been affected by the heat in making the repair. It is contended by the company's representatives that operate these machines that where the asphalt pavement is repaired in this manner that there is a perfect union or bond perfected between the new and the old pavemet, so perfect in fact that it would be impossible for an expert to detect where the union was made. I think this theory erroneous and not substantiated by facts which was demonstrated in Omaha some three or four months since. A case was being tried before one of our courts in which this question was involved and it was clearly proven in this case by a practical demonstration before the court that there was no bond whatever between the new topping and what remained of the old asphalt between it and the concrete base. It was shown in this manner: A piece of asphalt topping about 18x24 inches was cut out down to the concrete base. It was taken from a pavement which had recently been repaired by the new method. There had been about three-quarters of an inch of new material put on in this instance, and when this piece was taken from the pavement the old and the new portions separated very readily. As you are aware the surface of the old asphalt on which the new is placed resembles a fluting iron, and in this demonstration every flute was perfect and the surface remained perfectly smooth on either one and they both fitted to one another perfectly, and which was shown that there was no bond nor never had been between the new and the old asphalt, and went to show conclusively to my mind that it is an impossibility to make a union of two asphalts when one is cold and the other is hot, and proves the established theory by which all asphalt pavements are laid, that you must have the asphalt or the different ingredients that enter into the mixture at a certain temperature in order to make a perfect paving cement, and with what experience we have had I maintain that the only practical method of repairing asphalt pavements is to cut the old asphalt surface clear down to the concrete base. One of the reasons on which I base my theory is that if three-fourths of an inch of asphalt topping is sufficient to bear the burden of traffic in making asphalt repairs why not adopt that plan in the laying of the new pavement? If three-quarters of an inch meets all requirements, then I see no reason why two and one-half inches of topping should be used. And another reason, and a very good one is, the slight difference in the cost between the new and the old method.

MR. GUTHRIE: What is the difference in cost between the two processes?

MR. MUNRO: Well, we have never asked for it, but hearing your paper read I notice that yours is 87 or 88 cents and for resurfacing by taking down to the base is about $1.29.

MR. GUTHRIE: I am asking what your difference was.

MR. MUNRO: We have never had a contract that way.

MR. GUTHRIE: But you paid for the work and know what it cost for cutting out a yard and for skimming.

MR. MUNRO: No, the contract was on the total area in our city, consequently we cannot get the price separately. We did make a contract two or three months ago, but we just asked for bids for taking clear down to the base, not on the skimming process.

MR. MUNRO: The first asphalt pavement was laid in Omaha in 1883, that is thirteen years ago.

MR. MUNRO: I would like to state for the benefit of the gentleman that we have got out a contract for less than what you have, 98 cents to $1.10 for resurfacing and 98 cents with new material. No old material is used.

MR. J. T. JEUP, Indianapolis: In Indianapolis the skimming patches are not made less than an inch in thickness. We have had considerable experience in that kind of patches, patches that were less than that, that have scaled off, and I do not find that the bond of the skimming patched with the old asphalt is very good. In the next year we will discard the skimming process. The cost for these patches in the last year for skimming has been 75 cents a yard, for resurfacing, $1.50, and for places, cuts where concrete is taken up, $2.50.

MR. GUTHRIE: I would like to ask if you permit the use of old material in repairs.

MR. JEUP: No, sir, we do not.

MR. ADAM: I would like to make a remark as to Mr. Guthrie's suggesstion, that in the original specification it ought to be strictly delineated what the nature of the repairs should be. I think it would be very difficult to prescribe and lay out the manner in which the repairs are to be done, because you cannot tell what the nature of the repairs will be after the expiration of a five or ten year guarantee. I think the general style of specifications, saying that the contractor should turn over the street in good condition after the expiration of the guarantee, would cover the whole ground. You can certainly order the contractor to do any kind of repairs and to such an extent as would be required to put the street in a good condition.

MR. PEARSON: I think I have had to gain as much knowledge of asphalt as could be learned in five or six months, as almost any one. We have been in the unfortunate predicament of having only one asphalt company, the Barber Asphalt, and have a contract with them, made some seven years ago for a lump sum to keep our streets in repair for ten years. The repair they have to keep up amounts to about ten cents a yard per year on the whole street. This contract was made by a former administration. Since then reluctantly we have made another contract for keeping up part of one of our streets at 30 cents a square yard for the entire street per year for two years. We have the skimming process there too. We do not have any trouble at all with the separation of the two parts. We protect the material around the edges, as the gentleman from Buffalo has described, we put asbestos boards all around the space that we want to take out, consequently we do not burn anything except the portion that we want to take out. The rolls or waves have been our great trouble. We have not had very many cracks, but there is no reason, with such sudden changes of temperature, why we should not have them. A gentleman here yesterday, one of our Board of Public Works, said the thermometer in Louisville sometimes registered 24° below zero; that gentleman told the truth. However, you can not rely upon the thermometer he got the record from. The United States Weather Bureau, which is located on the top of one of our high buildings, registered at one time, winter before last, 10° below zero, and within 24 hours you could almost have gone in your shirt sleeves. That is the kind of climate we have. All last winter we had grass growing, and the winter before that we had three or four days when the thermometer registered 10° below zero, that was only for three or four days. We do not have much snow in our country to protect our streets during cold snaps. Any one who has studied this problem will understand that in New York and Boston and Minneapolis when it comes cold weather it stays cold; it does not change back and forth all the time as it does in Tennessee and Kentucky and in this middle section, so that we should have trouble from cracks, but do not. I do not believe expansion and contraction in asphalt amounts to anything, but the rolls do amount to something. Our street, Broadway, is about 125 feet wide, we have 90 feet of roadway. When the street was first built there was a space left in the middle of the street for the car line that was unpaved. The roadway on each side of this space was put down in asphalt, by the Barber Company. I do not just remember the width, I believe 30 feet on either side. We get all our stone for our repairs from our workhouse quarries, which are situated at the end of this street, and the consequence is that all of the very heavy hauling from all these quarries (our heaviest traffic) has to come down Broadway. After the asphalt part of the street was built, the space where the car tracks were being very dirty and dusty (at that time we had mule cars) it was decided to cover it with vitrified brick. Now, the space on the outside of the rails is asphalt and between the tracks is vitrified brick. The vitrified brick has only been down a very few years and it is almost all to pieces. These heavy teams have learned that in the summer time if they travel on the asphaltum they are traveling up-hill. The asphaltum gets soft in hot weather and rolls up in front of the wheels. We have 95° sometimes, which is rather an extreme, though I have seen it even more than that. At about 94° the asphaltum gets soft, consequently the wagons are climbing up-hill, and of preference they leave this apparently smooth asphalt street and go onto the rough brick as they come down the street loaded, because it is hard and firm, though rough. On the other side of the street they go on the asphalt, because they go back empty to the quarries. Now all those rolls are caused simply by the traffic shoving the warm doughy mass of asphalt ahead into troughs or waves across the street. So far as the cost of repairing cuts is concerned, there was a contract made some years ago, as I said, for general repairs, but if we have a place cut out where there is an opening made for a sewer or anything of that kind, the price we pay is $1.50 per square yard and where we cut the concrete $2.00 per square yard.

Mr. Cappelen: I would like to make the following motion:

That the committee on street paving be requested to prepare a set of specifications for governing the point "What Constitutes an Asphalt Pavement in Good Repair, Particularly With Reference to the Condition the Pavement Should Be in at the Expiration of the Guaranty."

Mr. Pearson: The gentleman asks how he could tell whether a street was in good repair or not. Only a short time ago I had to inspect a street that had been guaranteed and the guaranty had just expired after five years. I found no difficulty at all in finding out what should be called "in repair." I just took my penknife and bored holes right down to the concrete, and if it was not two inches thick they repaired it. It was a simple thing to find out. There were, however, in that street, but very few places only five or six where the wearing surface was thinner.

The motion offered by Mr. Cappelen was put to vote and carried.

Mr. Drake, Buffalo: I think the sympathies of this body should be extended to any city in the United States where the conditions require an expense of 30 cents per square yard per year for keeping their asphalt pavements in repair.

THE PRESIDENT: I have no doubt but that they have our sympathies.

MR. DRAKE: I think we ought to go a little further than the sympathy. I think we should endeavor to assist them in securing better contracts in the way of keeping their pavements in repair. It is only a couple of years ago, I think, that Captain Green of the Barber Asphalt company in New York stated that they would be willing to obligate themselves to keep all the asphalt streets of Buffalo perpetually in repair for five cents per yard per year. Perhaps this information would assist the city of Louisville a little in securing a better state of things in that town. There is one factor that enters largely into the cost of repairing asphalt pavement that has not been touched upon, and that is the necessity of making the repairs immediately when the breaks commence in the surface. Especially is this so on the streets where heavy traffic prevails, because the edges of the fractures are constantly breaking off, enlarging the rupture, and you all know, those of you who have had experience, that the period maintainance of the pavement is in the hands of a contractor, he does not allow it to go very long, providing the season is propitious before making the repairs, and thereby saving money. I think that should be taken into consideration in reaching the cost of repairing asphalt pavements generally. It is not good policy to neglect necessary repairs in any kind of pavement and especially asphalt.

THE PRESIDENT: I think we will have to close the discussion on this subject as the time of the morning session is rapidly passing.

I have the following communication which the members of this Association will take due notice of and govern themselves according to their own convenience:

"Mr. G. H. Benzenberg, President American Society Municipal Improvements, Chicago: Dear Sir: I am instructed by the President of this Society (Western Society of Engineers) to extend to your Society, while in the city, the privileges of our library and reading room. Yours truly,

NELSON L. LITTEN,
Secretary."

The club rooms are located at 1737 Monadnock Block, the building diagonally opposite the Great Northern.

It was moved by Mr. Horner that the invitation be accepted and a vote of thanks be extended to the Western Society of Engineers for their courtesy.

Carried.

Mr. J. A. Cabot, Cincinnati, Ohio, Chairman, read the following report of the Committee on Electric Street Lighting:

REPORT OF THE COMMITTEE ON ELECTRIC STREET LIGHTING OF THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

MR. PRESIDENT AND GENTLEMEN:

I have the honor to submit in a tabulated form* the result of the labors of your Committee on Electric Street Lighting, and beg leave to read the following:

This committee commenced work early last spring by having the necessary stationery printed; they also compiled and formulated a question sheet, which is hereto attached, which accompanied a typewritten letter, which was sent to 1,897 cities throughout the United States, Canada and Europe. It is the most complete list of questions I have ever seen; in fact, it was copied and sent out by the Committee on Street Lighting of New Haven, Connecticut. Of these 1,897 only 171 cities answered them, and am sorry to say that only 24 cities of 49 represented on this Society's membership list returned the blanks with answers to the questions.

The total population of the one hundred and seventy-one cities tabulated is 6,654,096.

There are one hundred and eighty-seven companies furnishing electric light in these one hundred and seventy-one cities.

Life of contract varies from one to twenty-five years (Davenport, Iowa, has a twenty-five year contract).

(Springfield, Ill., has a contract to furnish light until city purchases plant.)

Number of miles of streets lighted by arc lamps, 4,537.

Number of miles of streets lighted by incandescent lamps, 356½.

These tabulated sheets show	30,802	2000	Candle power.	Arc.
" " " "	11,572	1200	" "	
" " " "	7,026	16	" "	Incandescent.
" " " "	4,718	32	" "	
" " " "	251	50	" "	
" " " "	530	100	" "	

Lamps in operation.

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*See tables at end of proceedings.

Kendalville, Indiana, pays $30.00 per year for a 2000 candle-power light, which is the lowest (municipal plant).

Pine Bluff, Arkansas, pays $180.00 per year, which is the highest price of any city.

Canton, Illinois, pays $30.00, the lowest for 1200 candle-power lamp per year.

Butte, Montana, pays $168.00, the highest for 1200 candle-power lamp per year.

$4,288,207.19 is the total amount expended for arc lighting.

$180,450.32 is the total amount expended for incandescent lighting.

This tabulated report shows that eighty-one cities use the all-night schedule, twenty-three the moonlight, twenty-two midnight and twenty-five special.

There are twenty-three different systems in operation.

Twenty-nine cities report no method of determining the candle-power of arc lights, and fifty-three as having a method, but don't explain it.

There are eighty-six cities that base their arc light contracts on the lamp, and three on electrical consumption.

Only thirty-seven cities have a contract provision for testing candle-power.

Only eighteen cities have a contract penalty for shortage.

Eighteen use iron, and one hundred and forty-six use wooden poles.

Arc lights are supported at heights that vary from 8′ to 50′.

Four towns have arc lights supported on towers.

Sixty-eight cities support them on poles.

Sixty-five on mast-arms, and

One hundred and seventeen lowered from span wires.

Twenty-four cities own the pole line. The pole lines in one hundred and twenty-seven cities are owned by the company operating.

Sixty-two cities use the single, and one hundred and eight the double carbon lamps.

Ninety-two cities use the high, fourteen the low tension, and seventeen alternating arc lamps.

Circuits carry various number of lamps, ranging from 25 as a minimum to 125 as the maximum.

There are 128 cities using plain, 28 ground and 8 opal globes.

Where companies own pole-lines the city receives from 2¼ to 50 cents per pole.

Outages are reported in sixty-eight cities by the police, in seven by citizens, in ten by inspectors and trimmers, and six have no system of reporting.

One hundred and thirty-four cities use round carbons and fifteen "Eliptical".

The total expense for lighting these one hundred and fifty-nine towns and city amounts to $4,468,657.51.

Twelve cities do not give cost of lighting.

Minimum cost for light (arc) $600. Idaho Springs, Colorado.

Maximum cost of lighting (arc) per year $486,444. New York City.

Minimum cost of lighting (inc.) $18.

Minimum cost of lighting (inc.) $18. Montpelier, Vermont, 1 lamp of 32 candle-power.

Maximum cost of lighting (inc.) $66,830, St. Louis, Mo.

Minimum cost of light per year $864, Nebraska City, Neb. Arc and incandescent lamps.

Maximum cost of light per year $488,144, New York City. Arc and Incandescent lamps.

The smallest town heard from is Savannah, Mo., with a population of 1,288.

The largest, New York, with a population of 1,515,301.

I herewith extend to my co-laborers my hearty thanks for their assistance in collecting and compiling these statistics and their uniform courtesy throughout the entire time we were working and collecting the data.

QUESTIONS ASKED BY THE
COMMITTEE ON ELECTRIC STREET LIGHTING
—OF THE—
AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS
CINCINNATI, O.

....189...

GENTLEMEN—

The following is a correct Statement of the Street Lighting in the City of..

1. Names of Companies furnishing Lights..............................
2. Life of Contracts: From..............189.. to..............189..
   From..............189.. to..............189..
3. No. of 2,000 C. P. Arc Lamps in operation..............................
4. No. of miles of streets lighted by same..............................
5. Cost of same per night................or per year..................
6. No. of 1,200 C. P. Arc Lamps in operation..............................
7. No. of miles of streets lighted by same..............................

8. Cost of same per night................or per year..................
9. No. of 16 C. P. Incandescent Lamps in operation... ....
10. No. of miles of streets lighted by same...............................
11. Cost of same per night............ ...or per year ....
12. No. of 32 C. P. Incandescent Lamps in operation...... ....
13. No. of miles of streets lighted by same.............. ....
14. Cost of same per night..................or per year...............
15. No. of 50 C. P. Incandescent Lamps in operation........ ....
16. No. of miles of streets lighted by same............. ....
17. Cost of same per night..................or per year...............
18. No. of 100 C. P. Incandescent in operation........... ....
19. No. of miles of streets lighted by same... ....
20. Cost of same per night..................or per year...............
21. No. of Gas Lamps in operation. ....
22. No. of miles of streets lighted by same...............................
23. Cost of same per year ....per 1,000 cubic feet.............

Schedule, 24...... Electric.	All Night.........	Schedule, Gas.	All Night..............
	Moonlight.............		Moonlight.............
	Until Midnight.........		Until Midnight.........
	Special................		Special................

25. What Arc Lighting System used.. ....
26. How is C. P. of Arc Lights determined.. ....
27. Is Arc Light Contract based upon electrical consumption or per lamp..
28. What contract provision for testing C. P. or current and voltage......
29. What contract penalty for shortage........... ....
30. Iron or Wooden Lamp Poles used................... ....
31. At what height above street are Arc Lamps supported........... ....
32. How are Lamps supported:
    - Fixed on Poles............ ....
    - On Mast-arms..... ....
    - Lower from Span Wires.. ....
33. Are Lamp Poles owned by City or by Company.......... ....
34. What Arc Lamps used:
    - Single Carbon.............. ....
    - Double Carbon.................................
35. What Carbons used:
    - Round.......... ....
    - Elliptical.......................... ....
36. Arc System:
    - High Tension.................................. ....
    - Low Tension. ....
    - Alternating . ...
37. What, if any, limit upon number of Arc Lamps per Circuit.... .....

38. Globes in use:
    Plain...
    Ground ....
    Opal ....
39. No. of Arc Lamps:
    On Overhead Circuits..................................
    On Underground Circuits ....
40. What Insulation Resistance Tests on Circuits ....
41. Are Pole Lines owned by the City or the Company.......
42. Are Conduits owned by the City or by Company..........
43. Name or Character of Conduit in use...................
44. Miles of Conduit in use...............................
45. Miles of Duct in use..................................
46. What Annual Rate paid City for Pole Lines or Conduits.........
47. What Incandescent Lamps are used......................
48. What System of Operating Incandescent Lamps...........
    Low Tension...
    High Tension..
    Alternating ....
49. How is the C. P. of Incandescent Lamp determined......
50. What Contract Provision for testing same..............
51. What Contract Penalty for Shortage....................
52. How are Incandescent Lamps supported..................
53. How high above street ....
54. No. of Incandescent Lamps.............................
    On Overhead Circuit...................................
    On Underground Circuit................................
55. Does City own the Electric Lighting Plant.............
56. If owned by the City—
    Cost of Electric Light Machinery......................
57. Cost of Steam Power Plant.............................
58. Cost of Water Power Plant.............................
59. Cost of Pole Lines and Wires..........................
60. Cost of Underground Construction and Wires............
61. How are Outages reported..............................
62. What Deductions are made from bill when Outages occur...........
63. Character and Horse-power Engines used................
64. Character and Horse-power Boiler used.................
65. Kind of Fuel used. ....
66. How are Parks lighted ....

....

....

On motion the report of the committee was adopted and ordered printed in the proceedings.

THE PRESIDENT: You may obtain an idea of the labors of this committee when you behold the work that is represented by those three blue prints (indicating prints on the wall). It is something that the committee, had it at first known what it would amount to, might possibly have shirked, but they have gone through it very faithfully and I think that those tables are going to be of a great deal of value to the members on account of the vast amount of information contained in them. They will, of course, be printed in the proceedings. Mr. Cappelen has a paper upon this subject.

MR. CAPPELEN: As one member of that committee I have brought you a souvenir of the part that I took in the labors of that committee in the form of one special sheet here, and I will be delighted to donate them as far as they will go. I would like to state that during the last two weeks in Minneapolis we had so much rain that I could not get out any more prints, but if anybody wants a copy please leave the name with me and I will see that it is forwarded. The blue print contains the information received from ten states, fifty-nine cities. Mr. Cabot, the Chairman of the committee who so excellently handled the matter in getting up the question sheets, turned over to me the following states, as my share of the work:

Michigan, Illinois, Nebraska, Kansas, Wisconsin, Iowa, Minnesota, the two Dakotas, Canada, Wyoming Washington, Montana, Oregon and California.

No information was received from the Dakotas, Oregon and Canada, although repeated attempts were made. Reports were received from eleven states and fifty-nine cities. The attached list of questions were asked some one hundred and fifty cities, and the information obtained is all compiled on the accompanying print. I herewith, then, beg to submit the contents in a condensed form, as follows, to-wit:

The average cost per year per lamp of 2000 candle-power in the following states is as follows.

In the State of Iowa	$79.91
" " " " Michigan	81.80
" " " " Kansas	91.84
" " " " Wisconsin	93.00
" " " " Nebraska	109.33
" " " " Washington	110.33
" " " " Minnesota	124.60
" " " " California	129.50
" " " " Wyoming	162.00

The average of 48 cities in 10 states being $95.31 per 2000 candle-power lamp per year. This includes all night, as well as moonlight and special service. The average cost in 18 cities, all night service, is $108.85. The average cost for 30 cities on moonlight schedule is $89.79.

The cheapest all night lighting with 2000 candle-power lamps is done in Rockford, Ill., for $52.00 on a five year contract; next to this comes Ottawa, Ill., lighting done by the city for $57.50; Detroit, Mich., $84.70, and Tacoma, Washington for $100.00 or an average cost when done by the city at $80.73 per lamp per year.

As stated before, the cheapest contract lighting for all night is $52.00, then comes Pittsburg, Kansas, 75.00, 21 year contract; Stevens Point, Wis., 78.00; time of contract not known.

The average cost by contract is $116.91 per lamp per year. The lowest price all night service when done by Street Railway Company is $109.00, the highest $132.00 or an average of $120.50.

The cheapest moonlight schedule is in La Salle, $46.00, done by the city, average by city $60.00. Lowest by Company is $69.00; average, $99.95; highest, $144.00.

The average of 1200 candle-power lights for all night service is $78.74.

The average of 1200 candle-power lights for moon-light service is $43.20.

Butte, Mont., charges $168.00 for all night service.

Los Angles has some 3000 candle-power lights at $198.00 moonlight schedule.

The following arc light systems are in use:

Thompson Houston, 22 cities; Brush, 8 cities; Westinghouse, 4 cities; Western Electric Company, 2 cities; Standard, 2 cities; Excelsior, 2 cities; Ft. Wayne, 2 cities; Jenney, 2 cities; Schuyler, 1 city; and Siemans Halske, 1 city.

The candle-power, arc light is determined in 12 cities by amperes and volts; generally ten amperes and from 45 to 50 volts. In one city it is guessed at and in one city photometer is used. Distinct contract provision of determining current voltage exists only in five cases, where the city electrician is supposed to make tests. Deductions for shortage is made generally pro rata or from 5 cents per hour to $1.00 per night per lamp.

Three cities use iron towers, two iron posts and all the rest wooden posts. In twenty-five cities the lamps are suspended at a height of from 30 to 35 feet above the street pavement. In 19 cities at from 20 to 30 feet above the street pavement. In 13 cities at a height of 40 feet above the street pavement.

In 3 cities at a height of 125 feet above street pavement and in Detroit up to 175 feet above the street pavement.

The lamps are fastened in 16 cities to the poles, in 8 cities to the mast arms and 46 cities on span wires.

The City of Rockford owns the poles and receives 30 cents per pair of wires on each pole. Springfield receives 25 cents per pole, Madison 2¼ cents per pole and Davenport 50 cents per pole.

Six cities use single round carbon, 4 cities use single elliptical carbon, and the rest use round double.

Opal globes are used only in two cities; the plain ones are used everywhere else.

The limit of lamps on a circuit is 50, in one case 125.

Insulation resistance is from 1 to 3 Megohams per mile per 100 volts.

Detroit, Mich., is the only city owning its own conduit, and has 12.7 miles made of vitrified clay pipe. Milwaukee has 41 miles of 3 and 4 inch cement lined pipe conduit and Minneapolis has 40 miles of conduits consisting partly of the Dorset system, partly of iron pipe and partly of cement lined iron pipe.

Four kinds of incandescent lamps are used: Thompson Houston, Diamond, Edison and Sunbeam.

The cost of the plant in Detroit complete is $630,000, operating 1500 2000 candle power lamps, or $420.00 per lamp.

The cost of the plant in Bay City, Mich., complete is $32,674, operating 81 2000 candle power lamps or $403.00 per lamp.

The cost of the plant in Bloomington, Ill., complete is $83,000, operating 300 2000 candle power lamps, or $276.60 per lamp.

The cost of the plant, complete, in Topeka, Kan., is $46,888, operating 184 2000 candle power lamps, or $254.00 per lamp.

The cost of the plant, complete, in Arkansas, Kan., is $54,500, operating 92 2000 candle power lamps, or $592.00 per lamp.

The cost of the plant, complete, in Fremont, Neb., is $20,000, operating 70 1200 candle power lamps, and the cost of the plant, complete, in Canton, Ill., is $45,000, operating 120 1200 candle power lamps, or $286 and $375 respectively per lamp.

The Corliss engine has the preference, next the Buckeye and then the Ball. Generally, the boilers are tubular, with the exception of Detroit, where the Peck boiler is used, and in two or three cases water tube boilers are used.

The fuel is generally slack, and soft coal lignite is also used. I am sorry to state that, judging from the general information received, a great many of the various light stations are apparently run in a haphazard way.

Two and one half years ago, I made complete plans, specifications and estimate for a 1000 2000 candle power light station, having a relay of 300 lights in addition. The cost per lamp per year for every night and all night schedule, I found to be about $76.00; including in this cost is 4% interest and 6% depreciation on the entire investment. The land for the building belonged to the city, so no charge is made for that. The amount estimated for salary per year per lamp was $25.00. Bay City, Mich., actual salary account per lamp per year is $23.20.

The plan for building the city's own plant was voted upon at the last election and was defeated. So we are to-day paying $150 for all night service and $125 for moonlight schedule per year per lamp of 2000 candle power.

One of the most interesting cases is the City of Sprinfield, Ill. As the city was indebted to the legal limit and unable to raise funds sufficient without incurring further debt, and wishing to own its own plant for lighting, the mayor of Springfield made an agreement with a syndicate of local capitalists, the latter to build the plant, the city to pay for the arc lamps $113.33 per annum per lamp, moon-light schedule, the difference between $133.33 and $60.00 to be applied to the future purchase of the plant by the city. The item of $60.00 is the price agreed upon as a maximum cost of procuring one arc lamp per year; the syndicate to furnish the current free of cost of 450 16 candle power lamps, alternating incandescent for lighting the public buildings of the city, the city in turn furnishing the syndicate free of cost, water for steam purposes. The syndicate also does an extensive commercial business, both arc and incandescent.

The city is supposed to receive 25% of the gross receipts of this business to be applied toward the purchase of the plant.

The following suggestions might be made as the best method of street lighting.

For densely populated cities and districts, two lamps in series placed side by side on 110 volts incandescent circuit "conduit work" is probably the most desirable. For sparsely settled districts, the series system with areal lines is most economical and satisfactory. All arc lighting ought to be done in continuous current, the maximum number of arcs on a string 200, as this would give about 10,000 volts. From point of economy and as an ideal plant, the slow speed Corliss engine or Mackintosh & Seymour (130 revolutions) engine with dynamos running from shaft, would be to recommend.

Fairly and good results, and next best to recommend, would be a pair of arc machines, connected to a high speed engine, like the William, giving a total number of arcs of 400.

The question of conduit work is a very serious one, and should not be used only where it is absolutely necessary, as trouble is caused continuously from short circuiting. Edison is the safest in the world; however, suitable only for low potentials, say up to 500 volts.

The trouble with cable work in conduits is this: That, in the first place, the highest degree of insulation must be adopted to prevent leakage and danger from this source. This high method of insulation necessarily creates another danger, to-wit:

The creation of electrostatic charges, which is liable to destroy the cable and interfere with the service, and the fact is, that to-day nothing is absolutely safe.

Concentric paper cables have the least electrostatic capacity, but, all the same, a great deal of trouble is caused from puncturing. It is a well known fact that in the underground work in London where cables are suspended in the tunnels, punctures are caused by rats smelling the cable—the rat is killed.

The London Deptford Station has to be shut down quite frequently by trouble of this source.

There seems to be some dispute as to the best conduits of the following kinds, to-wit: The Camp Terra Cotta, the McRoy Terra Cotta and the Cement lined iron pipe conduit made by.

I believe personally that the best conduit has not as yet been made, but that when Mr. Ransom of Chicago will have his idea perfected of making the conduit in one body of concrete, as he is making ducts for carrying water and sewerage, I believe that his will be the nearest to perfection.

Not being an expert on electricity, I simply advance the above ideas from my own knowledge and information that I have been able to obtain upon the subject.

MR. HERRMANN: We have with us this morning the Mayors of several cities who are not members of this Society—Chicago, Milwaukee and Cincinnati—and I move that the courtesies of this convention be extended to all the Mayors present who are not members of this Society.

The foregoing motion was unanimously adopted.

THE PRESIDENT: Gentlemen, I suppose that you all remember the exceptionally cordial and hearty greeting that was extended to us by the Mayor of Cincinnati a year ago. (Applause.)

It was the unanimous opinion of every one who attended the convention last year that Cincinnati did not make a mistake in electing Mr. Caldwell, Mayor, and the sentiment of its own citizens has been to that end right straight along, for I understand there never has been one who has been quite so popular after having served years in office as Mr. Caldwell is to-day.

Mr. Caldwell, who was greeted with great applause, then spoke as follows:

MAYOR CALDWELL, Cincinnati, O.: Mr. President and Gentlemen of the Municipal Society: This is such a surprise that I am unable to collect my thoughts sufficiently to say that which I would like to say to you. I am certainly very much obliged to you for the compliment you pay me as the representative of that great city down in the southwestern part of Ohio. We remember with a great deal of pleasure your meeting in Cincinnati last year. I believe this organization is destined to do a great deal of good. The meeting together of officials which results in the exciting of ideas must necessarily broaden and give you new thoughts by which the government of municipalities may be improved. I think the great question in this country to-day is the proper government of municipalities and I know that it is the heart's desire of each and every official to do that which he can for the highest and best good of the people he represents. Therefore, it is that the wideawake officials in the departments of the different cities take such an active interest in an assemblage of this character. Gentlemen, I am certainly very much obliged to you and trust our meeting will result in profit to you all.

THE PRESIDENT: Gentlemen, you will pardon me if, the hour being late, I proceed with the business of the meeting and give you an opportunity sometime later in the day, this evening perhaps, to hear from the other gentlemen. I would like to have the privilege of introducing to you sometime during the day the Mayor of Milwaukee, but business before pleasure, and I know the Mayor of Milwaukee appreciates that fact as much as any one. The next is a paper by Mr. Cabot on "Municipal Control and Inspection of Electrical Construction in Cincinnati."

Mr. Cabot then read the following:

MUNICIPAL CONTROL AND INSPECTION OF ELECTRICAL CONSTRUCTION IN THE CITY OF CINCINNATI.

BY J. A. CABOT, CITY ELECTRICIAN, CINCINNATI, O.

Electrical construction dates back to the year 1844, when the first wire was strung on poles between Washington and Baltimore by Professor Morse, the inventor of the telegraph. This class of construction has been steadily increasing until it has grown to enormous proportions throughout the country; in fact, it has grown to such an extent that it was necessary to enact laws in several cities to reduce the number of wires and poles by placing the wires underground. There are still a great number of cities that have not as yet arrived at the point of placing all wires underground, due to lack of legislation compelling wires to be placed where they naturally belong, i. e., "Underground"; also another reason, which I think is a good one, the unwillingness of municipalities to wreck electrical companies by forcing all the wires at one time underground, for it is necessary to take into consideration the enormous amount of money that is invested in overhead construction; and to force the electrical companies to place their wires underground before the present construction had depreciated to a point that the companies themselves feel they could afford to remove them from overhead, would most certainly be a great hardship, which they no doubt would resist by process of law. The prospects are that overhead electrical construction will remain for some years to come. I think it would not be out of place to exhibit and explain the system in vogue in Cincinnati, hoping thereby to elicit from the various members of the society an explanation of the system of issuing permits and the inspection of the wires in the cities represented here.

The City of Cincinnati is governed by Boards, who have control of the various branches of municipal government. The Electrical Department, with which I have the honor of being connected, is one of the ten departments controlled by the Board of Administration. We have a standard blank application, printed in copying ink, so the companies who wish can keep a copy of all applications. These blanks are perforated with two holes on top to facilitate filing. Exhibit 1.

Exhibit 2 is an application for service connections; as it is sent to the Board of Administration by the companies, it is then sent to the Electrical Department with power to act (service connection consists of short lines from main line to building) and if the service is necessary, a permit, consisting of permit and cut-in-ticket (Exhibit No. 3), is issued. These permits are bound in book form, consisting of stub, permit and cut-in-ticket, (Exhibit No. 4), the name of the company, the location of service, the number of the ordinance controling this class of construction, date of issue, date of resolution of Board, date of expiration (i. e. how long permit is valid), the character of wire to be used, if for overhead or overground service, is written and stamped on the permit, (Exhibit No. 5): the stub, permit the cut-in-ticket bear the same number, the reverse side of cut-in-ticket is stamped with the date of issue and expiration, if underground or overhead, location of service, and character of wire, to be used. This is done so that when cut-in-ticket is returned for inspection, the inspector knows what insulation should be found on the wire. This is sent to the company asking for it free of cost. When the work authorized by this permit is finished, the cut-in-ticket is returned to the Electrical Department, which is a notice that work is ready for inspection; it is then given to the inspector to inspect the construction; he ascertains if the work is done in accordance with the ordinance, which controls this particular class of construction, and if insulation is the same as sample submitted with application. If service is put in, in accordance with the ordinance, the cut-in-ticket is returned to the Electrical Department by the inspector, who marks it "O. K.," then a ticket termed an "O. K. Ticket" (Exhibit No. 6) is made out and sent to the Company as a final record. If the service connection is not put in, in accordance with the ordinance a "Defective Ticket" is issued (Exhibit No. 7) with a note written on the face of the ticket, stating what should be done to meet the requirements of the ordinance of the Electrical Department. The work might be done in accordance with the ordinance, but not with the requirements of the Electrical Department, i. e. unsightly, which would call for a defective ticket. The companies are then required to make the service connection in a manner requested by the department; when this is done the same service is reinspected, and if found O. K. a reinspection ticket is sent to the company. That ends that particular service. These O. K. tickets are bound in book form, consisting of stub and ticket which are both identical in wording and numbering. The stubs remain in the book and are the office records.

There is also issued to the Companies a Special Permit (Exhibit No. 8) for work such as stringing long trunk lines and erection of poles. They follow the same course with the exception that the application comes to the Electrical Department for report and recommendation. When an application is sent to the Electrical Department for report and recommendation, the inspector goes forth to find out (in case of line construction) if there is sufficient space on pole lines to accomodate these wires, also that when lines are strung that they will not interfere with the city lighting by being strung too closely to lamps or mast-arms or too near to poles, preventing easy access to wires and fixtures of the other Companies, and in case of the erection of poles to see if it is possible to use poles already standing.

A report is sent back to the Board of Administration with a favorable or unfavorable recommendation, as the case may require; if favorable the Electrical Department is authorized to issue permit, and when work is finished the cut-in-ticket, which is also attached to this permit (same as the service) is returned to the Electrical Department, and the same inspection takes place and O. K. or Defective ticket, as the case demands is sent to the company.

The applications are stamped with the date they are received by the Electrical Department; the number of the permit; date and time of issue; date of expiration; also the character of insulation on the wire submitted (Exhibit No. 9). The wire submitted is tagged with a linen tag bearing the date and number of permit, name of company submitting same with number of building it is to run into, and date of expiration, (Exhibit No. 10).

The applications are filed according to date in self-binders. The cut-in-tickets are pasted in books according to their numbers. The samples are placed in a special box for safe keeping. It can be readily seen that at a moment's notice all information can be given pertaining to any particular piece of electrical construction in the city.

All pole lines are platted and plats kept on record in the Department, as is also the case of house top lines. Each company is required to file a plat showing the location of all of their lines and a list of the buildings on which they are tied; these plats are corrected every three months. The filing of thes plats is done so that the department can readily know to what building any company has it wires attached; and in case a property owner calls up the Electrical Department, they can be told in a very few minutes to whom the wire belongs.

Up to within the last year the City of Cincinnati was burdened with dead wires.

There was appropriated two thousand ($2,000.00) dollars for the purpose of removing the dead wire strung by defunct companies and individuals. This wire was always causing trouble to buildings and the Fire Department. About seventy (70) miles of wire was removed during the first six months of this year, so at present there is not to my knowledge a single dead wire in Cincinnati.

The live lines are inspected once in about every two weeks for poor insulation, loose tee wires, broken insulators, or sagged wires; when defects are found the inspector reports then on blanks printed for that purpose, on one side diagramatically, and in writing on the other, (Exhibit No. 11). A letter is then written notifying the company owning the defective construction that they must repair it at once. If they do not notify the Electrical Department within a reasonable time that the defects are remedied, a second letter is written notifying them if these defects are not attended to, it will be reported to the Board of Administration. This always brings them to time, and the wires and fixtures are repaired.

EXHIBIT 1.

CINCINNATI, O., ________________________________ 189___

HON. BOARD OF ADMINISTRATION,
CITY OF CINCINNATI, OHIO.

GENTLEMEN:

We hereby petition your Hon. Board for Permit to

EXHIBIT 2.

CINCINNATI, O., October 5, 1896.

HON. BOARD OF ADMINISTRATION,
CITY OF CINCINNATI, OHIO.

GENTLEMEN:

We hereby petition your Hon. Board for Permit to make Overhead Connection at 31 West 5th St., for Incandescent Service with Direct Current, in making which connection we desire to use grade of wire as per sample enclosed.

Respectfully Submitted,

The CINCINNATI EDISON ELECTRIC CO.

By JOHN I. BEGGS,
Vice Prest. and Genl. Magr.

EXHIBIT 3.

SEC. 34, ORDINANCE 4285.

Immediately after the erection of any wiring or other outdoor construction for electric light or power, the company or person erecting the same shall notify the city inspector of electric constructions or the Board of Public Affairs that said work is ready for inspection, and no use shall be made of such wiring or its appurtenances for the purposes aforesaid until approved by the inspector.

No. 2230 CUT IN TICKET.

This Ticket to be returned immediately upon completion of work.

CHIEF ELECTRICIAN:

Dear Sir: The work done under and in accordance with Permit No. 2230 is as follows, viz:

Voltage, - -	220
Feet of Wire strung,	75
Size of Wire,	No. 8

Insulation, 3-braid weather proof.
25 16-C. P. Lamps.

THE CINCINNATI EDISON ELECTRIC CO.
JOHN I. BEGGS,
V. P. and G. M.

CINCINNATI, O., Oct. 5, 1896.

No. 2230

THIS PERMIT EXPIRES
OCT. 19, 1896.

OFFICE OF THE

ELECTRICAL DEPARTMENT, BOARD OF ADMINISTRATION.

CINCINNATI, O., October 5, 1896.

In accordance with the Terms and Conditions of Ordinance 4285 and as per resolution of the Board of Administration, of the October 5, 1896, inst.

THIS PERMIT ALLOWS

The CINCINNATI EDISON ELECTRIC COMPANY to make OVERHEAD service connection with No. 31 West Fifth Street.

Chief Electrician.

EXHIBIT 4.

STUB ATTACHED SAME AS PERMIT.

No. ----------------

THIS PERMIT EXPIRES ----------------

OFFICE OF THE

ELECTRICAL DEPARTMENT, BOARD OF ADMINISTRATION.

CINCINNATI, O., ------------------ 189----

In accordance with the Terms and Conditions of Ordinanec---------- and as per resolution of the Board of Administration, of the ---------- inst.

THIS PERMIT ALLOWS

The --

to make ---------------- service connection with ------------------------

----

------------------------------------ Chief Electrician.

SEC. 34, ORDINANCE 4285.

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No. ------------ CUT IN TICKET.

This Ticket to be returned immediately upon completion of work.

CHIEF ELECTRICIAN:

Dear Sir: The work done under and in accordance with Permit No. ------------ is as follows, viz:

Voltage --

Feet of Wire strung ----------------------

Size of Wire ------------------------------

Insulation ----------------------------------

CINCINNATI, O., ------------ 189---- Per ----------------

EXHIBIT 5.

SEC. 34, ORDINANCE 4285.

Immediately after the erection of any wiring or other outdoor construction for electric light or power, the company or person erecting the same shall notify the city inspector of electric constructions or the Board of Public Affairs that said work is ready for inspection, and no use shall be made of such wiring or its appurtenances for the purposes aforesaid until approved by the inspector.

NO. 2230 CUT IN TICKET.

This Ticket to be returned immediately upon completion of work.

CHIEF ELECTRICIAN:

Dear Sir: The work done under and in accordance with Permit No. 2230 is as follows, viz:

Voltage, - - - - 220
Feet of Wire strung, - 75
Size of Wire, - - No. 8
Insulation, 3-braid, weather proof.
25 16-C.P. lamps.

THE CINCINNATI EDISON ELECTRIC CO.
Per JOHN I. BEGGS,
Cincinnati, O., October 5, 1896. V. P. and G. M.

No. 2230

THIS PERMIT EXPIRES
OCT. 19, 1896.

OFFICE OF THE
ELECTRICAL DEPARTMENT,
BOARD OF ADMINISTRATION.

CINCINNATI, O., October 5, 1896.

In accordance with the Terms and Conditions of Ordinance 4285 and as per resolution of the Board of Administration, of the October 5, 1896, inst.

THIS PERMIT ALLOWS

The CINCINNATI EDISON ELECTRIC COMPANY, to make OVERHEAD service connection with No. 31 West Fifth Street.

Chief Electrician.

No. 2230

OFFICE OF THE
ELECTRICAL DEPARTMENT,
BOARD OF
ADMINISTRATION.

This Permit Expires
Oct 19, 1896.

Cincinnati, O.,
Oct. 19, 1896.

In accordance with the Terms and Conditions of Ordinance 4285, and as per resolution of the Board of Administration of the Oct. 5, 1896, inst.

THIS PERMIT ALLOWS

The Cincinnati Edison Electric Co. to make OVERHEAD service connection with No. 31 West Fifth Street.

3-B. weatherproof wire, Incandescent.

Chief Electrician.

STUB.

EXHIBIT 6.

OFFICE OF ELECTRICAL DEPARTMENT. No. 38

BOARD OF ADMINISTRATION.

CINCINNATI, October 12, 1896.

The CINCINNATI EDISON ELECTRIC COMPANY work done under SPECIAL Permit No. 1140, has been inspected and found DEFECTIVE.

3 No. 0 wires on Elm Street from 4th to 9th Streets. Tie-wire cuts through insulation. Wire strung too near to poles owned by CINCINNATI GAS LIGHT & COKE CO.

GEO. W. DAVIS,
Inspector.

J. A. CABOT,
City Electrician.

OFFICE OF ELECTRICAL DEPARTMENT. No. 38

BOARD OF ADMINISTRATION.

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Inspector.

J. A. CABOT.
City Electrician.

STUB.

EXHIBIT 7.

OFFICE OF ELECTRICAL DEPARTMENT. No. 3202

BOARD OF ADMINISTRATION.

CINCINNATI, October 17, 1896.

The CINCINNATI EDISON ELECTRIC COMPANY work done under SERVICE, Permit No. 2230, has been inspected and found O. K.

25 16-C. P. Incandescent Lamps.

SAM'L BLACK,
Inspector.

J. A. CABOT,
City Electrician.

OFFICE OF ELECTRICAL DEPARTMENT. No. 3202

BOARD OF ADMINISTRATION.

CINCINNATI, October 17, 1896.

The CINCINNATI EDISON ELECTRIC COMPANY work done under SERVICE, Permit No. 2230, has been inspected and found O. K.

SAM'L BLACK,
Inspector.

J. A. CABOT,
City Electrician.

STUB.

EXHIBIT 8.

SPECIAL PERMIT No. .... THIS PERMIT EXPIRES

....

OFFICE OF THE

ELECTRICAL DEPARTMENT, BOARD OF ADMINISTRATION.

CINCINNATI, O., ...189.....

In accordance with the Terms and Conditions of Ordinance ....and as per resolution of the Board of Administration of the.....................................inst.

THIS PERMIT ALLOWS

The

SPECIAL PERMIT No.............

CUT IN TICKET.—This Ticket to be returned immediately upon completion of work.

CHIEF ELECTRICIAN:

Dear Sir:—The work done under and in accordance with Special Permit No. ....is as follows, and is ready for inspection:

Voltage .... Insultion ....
Feet of Wire strung .... Poles ....
Size of Wire .... Instruments ....
Character of Wire ....
....
....

Cincinnati, O., ...189..... Per...........................

EXHIBIT 9.

CINCINNATI, O., October 5, 1896..

HON. BOARD OF ADMINISTRATION,
CITY OF CINCINNATI, OHIO.

GENTLEMEN:

We hereby petition your Hon. Board for Permit to make Overhead Connection at 31 West 5th Street, for Incandescent Service with Direct Current, in making which connection we desire to use grade of wire as per sample enclosed.

Respectfully submitted,

The CINCINNATI EDISON ELECTRIC Co.

By JOHN I. BEGGS,
Vice Prest. and Genl. Magr.

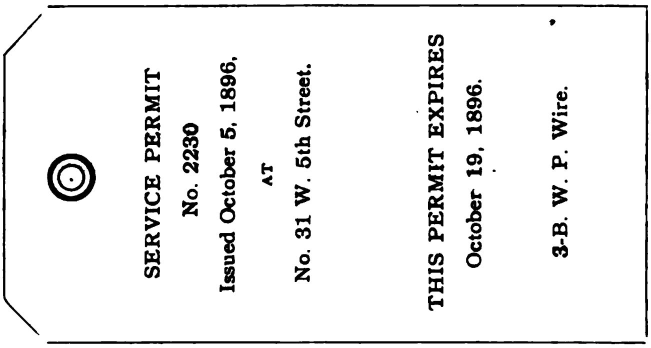
Received by Electrical Department, October 5, 1896.

PERMIT ISSUED
October 5, 1896.
No. 2230 9 A. M.

THIS
PERMIT EXPIRES
October 19, 1896.

3-B. Weatherproof wire.

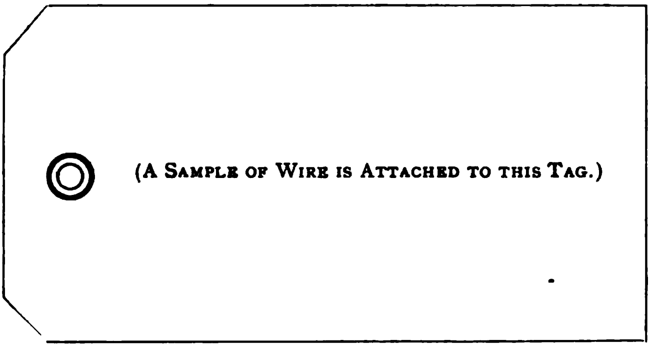
Exhibit 10.



SERVICE PERMIT
No. 2230
Issued October 5, 1896,
AT
No. 31 W. 5th Street.

THIS PERMIT EXPIRES
October 19, 1896.

3-B. W. P. Wire.



(A Sample of Wire is Attached to this Tag.)

EXHIBIT 11.

(FRONT)

ELECTRICAL DEPARTMENT.

B. OF A.

CINCINNATI, O.,------------------------------

REPORT OF --

(BACK)

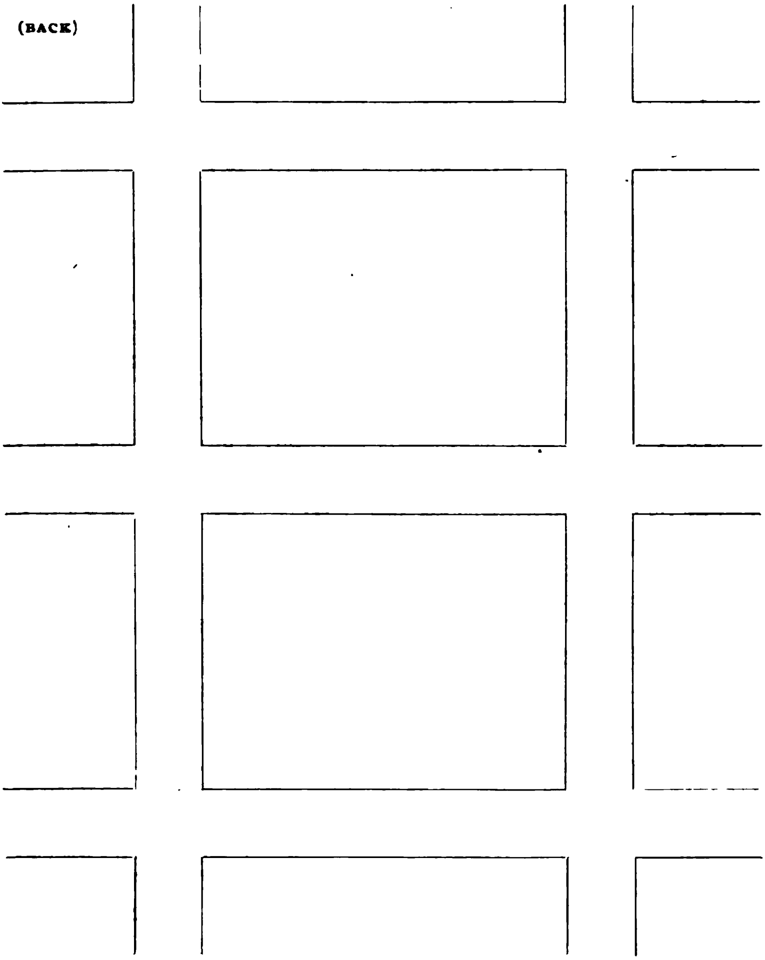


DIAGRAM OF--

THE PRESIDENT: Gentlemen, these papers are now open for discussion and bear in mind that these gentlemen are ready and willing to answer any questions that may be addressed to them.

MR. SHERRERD, Newark: Comparing general results and prices on electric light plants, the candle-power, of course, enters into the consideration of the question very materially. I notice that the reports do not give very positive answers in regard to testing candle-powers, and I would like to ask the gentleman who has spoken on the electric lighting question whether he was able to judge in these different cities that report 2000 candle-power, whether the lights were kept up anywhere near the accepted 2000 (nominal) candle-power standard.

MR. CABOT: It is a very difficult matter to test the candle-power of an arc lamp. It can be done by an expert with a photometer. The readings from a photometer vary according to the accuracy of the eye-sight of the man who is making the test.

THE PRESIDENT: I suppose the general method is by determining the number of amperes and volts.

MR. CABOT: Yes, it is the best method, in my estimation, to test for electrical consumption. The purity, size and shape of carbon, has a great deal to do with determining the candle-power of an arc lamp.

MR. CLARK, Bridgeport, Conn.: In making out my report for last year I was asked to say something about our electric lights. I would like to know, do you in Cincinnati or any other city use incandescent lights. If I understand it correctly, good incandescent lights can be maintained very much more cheaply than arc lights and more can be gotten in a block. This is what I would like to know something more about.

MR. CABOT: We do not use incandescent lamps for street lighting; it is more economical to use the arc lamps, for the reason we get 2000 candle-power with an expenditure of 450 Watts with the arc, against 16 candle-power for 53 Watts with the incandescent lamp; of course it would be expensive to use the arc lamps for alley lighting.

A MEMBER: May I ask Mr. Cabot, at what distance apart you place your arc lamps?

MR. CABOT: Our contract distinctly specifies that lamps shall be placed at intersection of streets, and where a block exceeds four hundred feet, an intermediate lamp be located. On suburban thoroughfares we place them every six hundred feet apart.

A MEMBER: You still have the gas lamps?

MR. CABOT: Yes, our city is divided into nine districts, and so far, we have five districts lighted with fifteen hundred and two arc lamps. We remove the gas lamps from off the streets and avenues, but leave them in the alleys.

A MEMBER: I would like to ask how you arrive at the candle-power of your lamps? By measuring the candle-power with the photometer, or the Watts by ampere and volt meter.

MR. CABOT: Our contract provides that measurement shall be made upon the basis of four hundred and sixty Watts per lamp. This I consider the best method of determining the candle-power of an arc lamp.

MR. STAINSBY: I noticed in the paper read before this last one that there was a great difference in the price of running the lights in the various cities. I did not hear any mention whether it was all run by steam or water power. I suppose that, if a city has water power, they could run a great deal cheaper than by steam. I would like to ask the gentleman who read the paper whether that was the case, whether all those cases as reported were run by steam or whether they were run in some instances by water power. The difference of a fraction over $50 and $20 seems to be very large in cities.

MR. CAPPELEN: In Minneapolis we have both water and steam, and in another city in Minnesota, St. Cloud, it is run by water power, and still Minnesota is the third to the highest of all as far as the price is concerned. It is a known fact that you can do lighting cheaper by water power than by steam. The companies simply put the lighting at the highest figure they can get out of a municipality. I am sorry to say that I did not get the reply from Portland, Oregon, but I was there this spring and saw the electric plant at Oregon City, where they have got a most magnificent water power, one of the most magnificent water powers in America. The current is generated at Oregon City and carried eighteen miles to Portland. The arc lights are simply beautiful; they are absolutely steady. I never saw any lights like them, but for some reason or other I could not get answers to my letters from them, although I know the superintendent personally. Probably for some reason or other they would not give their facts away. I could not get any figures as to cost. Also in Sacramento, Cal., the current is carried twenty-three miles, the longest distance in America, from a water power twenty odd miles away, and wherever you have water power, of course, you ought to get the light for a good deal less money, and we expect in Minneapolis during the next two years to get the benefit of the new water power; the Minneapolis Mill Company, the Pillsbury Company, that you all know about, is putting in a second dam across the river at an expense of $750,000, and they will generate 10,000 horse power for nothing but electric current, and we all expect to get a great deal of benefit from that concern in competition against our present General Electric Company.

MR. ALDERMAN, Eau Claire: I would like to ask Mr. Cappelen if I was correct in understanding his statement to be that the lowest price for lighting that he received was $50 and the next lowest price was eighty some odd dollars.

MR. CAPPELEN: Seventy-five dollars.

MR. ALDERMAN: I wish to state that in Eau Claire, where I reside, we have an electric lighting plant that furnishes at a cost of $75 per year per light. All lights schedule 2000 candle-power, and the number of lights that we burn is only 79, and we have a five-year contract at that price. The contract will expire in two years, I believe.

MR. CAPPELEN: I will say that a few years ago, three years ago I think, a proposition was made to the City of Minneapolis by a company to build an electric light plant for 1,000 lights of 2000 candle-power and light the city at the rate of $150 per lamp per year for five years and at the expiration of five years the company would turn over the plant to the city for a consideration of $1. The offer was not accepted.

The Chairman (Mr. Herrmann): I understand Mr. Cabot has another paper on this same subject.

Mr. Cabot: Yes, but that will come in to-night, I think. I did not bring my tracing.

The Chairman: Before adjourning for the noon hour Mr. Benzenberg says he has something to state in regard to the nominating committee. He will be here in a moment. There was a paper read here yesterday in regard to rumbling of brick pavement. Perhaps, while we are waiting there may be some members who wish to discuss that.

Mr. Thompson: I would like to ask Mr. Adam if he ever heard of any expansion on a brick pavement where sand was used for filling the joints?

Mr. Adam: We have in this year's contract provided for sand filling and paving mastic, on account of this rumbling noise. It seems a universal concession that where cement grout is used without providing in some way for expansion and contraction the noise will prevail. It was so bad upon a number of streets that some of the property owners threatened to go into court to set aside the assessment. They have not yet carried out their threats although it is a year since these pavements were laid. It seems that the people became accustomed to it. Quite a number like a brick pavement, but they dread the noise, and yet, as I stated in my paper, if they do not use cement grout I think they sacrifice the life of the pavement. Last year we used several kinds of brick in order to experiment with them, and determine which would give the best satisfaction. We have had some settlements in both shale and fire-clay brick pavements owing to some cause or other in spite of the concrete foundation.

Where the brick pavement consists of fire-clay brick it shows a greater wear than the Canton shale. Canton shale brick show up very well, although some of them have settled.

In the city of Easton the bricks are worn off one quarter to one half of their original surface. I was told the greatest amount of wearing takes place in the first three or four months, more so than in the following three or four years.

A MEMBER: I would like to ask the gentleman if the same rumbling noise exists where the filling is in coal tar.

MR. ADAM: We first commenced brick paving last year, and therefor we have had very little opportunity of trying other methods. This year the spaces between bricks were filled with sand or coal tar. In Roswell Avenue, where I used coal tar in intermediate spaces and along the curb, the pavement does not cause any rumbling noise.

MR. STAINSBY: So far as the city of Newark is concerned we have put only one kind of pavement down this year. New York and Brooklyn are in the same condition. The desire of the City of Newark is to know if the older cities that are here represented have had this rumbling noise in the past, or whether it is caused by the grout. It is not so much the information that we can impart to you, for last year the first brick pavement that has been put down in Newark was laid. Now, as to the Western city that laid this pavement last year, have you had this noise? New York and Brooklyn is troubled largely with what they have down. They have tried all kinds of experiments to prevent this noise, and yet the noise exists, and while we have not discarded the pavement, the noise is still there, and as Mr. Adam has said, they started a suit in protest against paying the assessment. Now, if there is any other party in the hall that can give us that information, whether they have ever had in their work of paving the street found this noise to exist.

MR. LEWIS: Mr. Adam refers to my experience in Brooklyn in his paper. I would like to say a word about that. He is disposed to attribute the buckling of the pavement to expansion.

When this thing occurred in Brooklyn I immediately began correspondence with every city in which I heard that a similar phenomenon had been experienced and in every case that I could hear of the pavement was laid very late in the year, was laid during and after the frost. This was the case, I am informed, in Poughkeepsie, Middletown, Troy and Newark, but I can not see myself why it is necessary to assume that this virtually monolithic surface had expanded to such a degree as to buckle. My conclusion in Brooklyn, in the case that Mr. Adam refers to, was that the sand cushion was frozen. We made every endeavor to thaw it out, and thought at the time we had succeeded, but I believe now we did not. We then pounded the cement grout. The result was that when the frost was gradually drawn out and the sand resumed its normal volume, there were voids left. These places were in patches and did not extend from curb to curb.

One word of explanation as to the way he refers to my breaking down the pavement with a fifteen-ton roller. That is true, but before that was done a row of blocks was taken up along each curb and this fifteen-ton roller worked on one block for two days. Not the slightest impression was made and not a joint was broken. The pavement was still monolithic. If this arch has formed by the rising due to expansion, I think it would be inevitable that the joints would have failed in some places. I could scarcely find a crack, this showing excellent workmanship, and I think the conclusion was justifiable that the trouble was caused by the local spaces, perhaps several feet in diameter, where there was a slight void between the brick and the sand cushion.

Mr. Adam: I cannot see why Mr. Lewis should doubt that this buckling has occurred, when I state the facts and the coincidence producing it. I had traced the separation of the brick pavement from the curb by the rupture of the cement grout along the curb. The block of that street is about 600 feet, and, as I stated, 125 feet from an intersection to the summit. At the further end of the block there was another buckling. It was at the header curb, extending back six feet and rising about five inches.

In the streets paved with the Canton shale brick the buckling is not so great as it is in those paved with clay brick. Where the brick pavement abutted an asphalt pavement the longitudinal pressure caused the latter to buckle also.

Mr. Lewis: I did not mean to say, sir, if I did give Mr. Adam the impression, that I did not want to accept his theory of expansion and buckling in Newark, but I do say that I do not see the applicability of it to the Brooklyn case.

Mr. Thompson, Peoria: We have brick pavements in which the interstices were filled with sand and others in which the interstices were filled with cement grout. If a brick pavement is properly constructed, there will be no rumbling when the joints are filled with either material. The rumbling is always caused by vacant spaces between the brick and the foundation, forming air chambers at these points. These spaces may be formed in a number of ways. If the sand bed is carelessly made, or not properly compacted, the settlement later will leave a space between the bed and the brick, or if the rows of brick are keyed up too tightly, they are forced off the sand bed a slight distance, which is sufficient to transmit a rumbling sound; or the same result is obtained if the brick are not rolled sufficiently to force them solidly into the sand bed. When the grout is placed in the joints, the pavement is formed into a solid mass of masonry, and it is impossible for the bricks to settle and destroy the air spaces. A brick pavement with cement grout is more noisy than one in which the joints are filled with sand, but if the sub-grade is solid, the concrete laid properly and all work done in a workmanlike manner, there will be no rumbling by the use of cement grout filling.

Mr. Stainsby: How did you put it in?

Mr. Thompson: We poured the grout into the joints, going over the pavement twice.

Mr. Stainsby: We went over ours three times.

Mr. Leasley, Youngstown: I think, as Mr. Lewis says, that this rumbling is purely local. That is the condition with us.

We have a street, about 3500 feet long, laid with the cement filling, and on that street there are only two or three small spaces where this rumbling is heard, and I do not see that it is any worse in hot weather than it is in cold weather and I do not think the expansion has anything to do with it. I am confident that it comes from slight defect in laying the brick. There is a large part of our street that we went over, after pouring the cement; if the cement is thin, there is a slight tendency to raise the brick. After the pouring a man should go over it and ram the brick down again. That is what we did, but we did not always succeed in getting them down, and I believe if a man goes over it while the cement is soft and just lightly tamps the brick down into the sand, it will obviate all this rumbling noise, but if the bricks are let float, when the water dries out of the cement it will leave a slight vacant space there. I believe that this has been the cause of the rumbling, and not any expansion.

THE PRESIDENT: Gentlemen, the hour has arrived when we should adjourn in order to take lunch and be at the train in time for the trip this afternoon.

Gentlemen, we have the matter of the selection of next place of meeting coming up this evening and it might be well to refer such invitations as have been extended to a committee, so that it can take up the matter this afternoon on the trip and be ready to report this evening.

It was moved by Mr. Thompson that all communications received on this subject be referred to a committee to be appointed by the President, which motion was carried.

DR. PRENDERGAST: Does the selection of the nominating committee come up at this meeting or later?

THE PRESIDENT: If the nomination of officers is to be referred to a committee, it had better be done now, so that the committee will have time this afternoon to make up its report.

It was moved that a committee of five be appointed to be known as the Nominating Committee.

Carried.

The President then declared that nominations for the nominating committee were in order and the following members were nominated from the floor: Dr. Prendergast, of Cincinnati; Mr. Frank V. Matty, of Syracuse; Samuel Brockman, of Milwaukee; Harrison Van Duyne, of Newark; Mayor Clark, of Bridgeport, Conn.

It was moved that nominations be closed and that the gentlemen nominated by the various members shall constitute the Nominating Committee.

Carried.

The President: I will appoint on the committee for the next place of meeting Mr. Sherrerd, of Newark; Mr. Holman, of St. Louis; Mr. Warder, of Cincinnati; Mr. Jackson, of Chicago, and Mr. Cappelen, of Minneapolis; to constitute a committee of five.

On motion the convention adjourned until 8 o'clock P. M.

THURSDAY EVENING, OCTOBER 12th, 1896.

George H. Benzenberg, President, in the Chair.

The meeting was called to order by the President at 8 P. M.

The President: Gentlemen, our evening session having arrived, I declare the convention in order again for the transaction of business as laid down in the program.

The first order of business specially set aside for this hour is the election of officers for the ensuing year.

Having appointed a Committee upon Nominations this morning, the first order of business will be to receive the report of that committee. Is it ready?

Mr. Prendergast, Cincinnati, O.: Yes, sir.

The President: Mr. Prendergast.

Mr. Prendergast: Mr. President and fellow members of the American Society of Municipal Improvements:

Your Nominating Committee begs leave to submit the following report:

We nominate for officers for the ensuing year:

President: August Herrmann, Cincinnati, O.
First Vice-President: E. B. Guthrie, Buffalo, N. Y.
Second Vice-President: William D. Kerr, Chicago Ill.
Third Vice-President: Ernest Adam, Newark, N. J.
Secretary: D. L. Fulton, Allegheny, Pa.
Treasurer: John L. Kennedy, Nashville, Tenn.
Finance Committee: L. W. Rundlett, St. Paul, Minn.; G. H. Munro, Omaha, Neb.; F. J. O'Brien, Oswego, N. Y.

Respectfully submitted and unanimously signed by every member of the committee.

J. W. PRENDERGAST,
S. J. BROCKMAN,
FRANK E. CLARK,
HARRISON VAN DUYNE,
FRANK V. MATTY.

THE PRESIDENT: Gentlemen, you have heard the recommendations of the Committee on Nominations.

Gentlemen, further nominations are now in order aside from those recommended by the Committee on Nominations. Are there any further nominations to be made?

MR. A. P. BUTTERFIELD, Cincinnati, O.: I move that the report of the committee be approved and that the Secretary be instructed to cast the vote of this convention.

Which motion was carried.

THE PRESIDENT: Gentlemen, by your direction the Secretary has cast the ballot of this Society for Mr. August Herrmann, of Cincinnati, O., as President; Mr. E. B. Guthrie, of Buffalo, N. Y., as First Vice-President; William G. Kerr, of Chicago, as Second Vice-President; Mr. Ernest Adam, of Newark, N. J., as Third Vice-President; Mr. D. L. Fulton, of Allegheny, Pa., as Secretary, and Mr. John L. Kennedy of Nashville, Tenn., as Treasurer, and Messrs. L. W. Rundlett, St. Paul, Minn.; G. H. Munro, Omaha, Neb., and F. J. O'Brien, Oswego, N. Y., as the Finance Committee; and I therefore declare them duly elected to serve you in their respective capacities for the ensuing year. (Applause.)

THE PRESIDENT: Gentlemen, I wish to compliment you upon the selections made by the Nominating Committee which you elected this morning to perform this duty. My own humble and private opinion is that they could not have done better.

This is a young organization, which will have to be managed and regulated with a great deal of care and circumspection. I do not think you could have entrusted its welfare into the hands of a more energetic, competent and conscientious lot of men who have the interest of this association at heart as much as any member of this organization, and I refer particularly to Mr. August Herrmann of Cincinnati, whom you have chosen as your President. I know, too, that the other officers whom you have this evening elected will heartily second his efforts in the interest of and in behalf of this Society.

In entrusting your future into the hands of such gentlemen I am satisfied that the progress, extension and interest of this Society will be well taken care of, and that when you meet one year hence it will be with a higher regard, a greater amount of work and an increased interest shown in the organization and the objects for which this Society was organized.

Gentlemen, I will call upon Mr. August Herrmann to approach the platform. (Applause.) Although under the Constitution I am not yet authorized to surrender the gavel, I extend to him the right hand of fellowship, and congratulate him in the name of the Society on his election to the Presidency of this Society.

MR. HERRMANN: Mr. President and Fellow Members: In selecting me as your presiding officer for the ensuing year you have conferred upon me a compliment for which I desire to return my sincere thanks. It is a compliment to me not only as an individual, but also a compliment to the city which I have the honor to represent here.

The city of Cincinnati recognizes the importance and appreciates the usefulness of this organization.

There is nothing that the various municipalities throughout this country desire more than a faithful, honest, careful and efficient management of their public affairs. To secure this for them the usefulness of this Society cannot be measured.

The officers which you have elected here this evening do not assume their official duties until after the final adjournment of this convention, but, as one of them, I desire to say I will leave nothing undone to secure, establish and maintain the permanency of this organization and the benefits which may result therefrom. (Applause.)

The delegates from Cincinnati are of the opinion that at our annual gatherings a little social diversion, sometimes, after we are through with our business, will not do any harm. Those of you who met with us at Cincinnati one year ago are probably aware of that fact.

On behalf of the Cincinnati delegates I extend to you an invitation to meet with us this evening immediately after the adjournment of the convention on the first floor of this building.

I thank you again for the compliment you have tendered me this evening. (Applause.)

MR. McCALL: The City of Duluth is young, but we think we have been very well treated and I will ask for the rising vote of thanks of this convention for our retiring President and Chairman.

THE PRESIDENT: I didn't catch what you said, Mr. McCall.

MR. McCALL: I asked for a rising vote of thanks for our retiring President.

MR. WADDELL, Chillicothe: The City of Chillicothe is old, but she seconds the motion. (Laughter.)

THE PRESIDENT: Gentlemen, I don't think any such motion or resloution is provided for in the program laid out for this convention.

MR. GUTHRIE: I move that the Secretary be ordered to take the motion.

(Which motion was carried during great applause.)

THE PRESIDENT: I thank you very heartily for it, gentlemen.

THE PRESIDENT: I wish to introduce to you Mr. Guthrie, the Chief Engineer of the City of Buffalo, N. Y., than whom you could not have done better in selecting as your First Vice-President.

MR. GUTHRIE: Thank you, Mr. President, and I think that your kind commendation would come better next year.

Gentlemen, I am greatly indebted to you for the honor which is accepted in the name of the City of Buffalo and State of New York, and certainly if a thunderbolt had come from the sky I could not have been more surprised than when it was announced, on coming into the hall this evening, that I had been selected your First Vice-President.

I consider this Society as having before it subjects which are of the greatest importance to each and every one of us throughout the land, and through its efforts we hope to see built up what we can meet with in no other Society, except the larger Society of Civil and Mechanical Engineers, which makes a study of special lines of work. But we are all engaged in work connected with municipal affairs and I see a great future for this Society if the work done so far is extended as it can be by strong and earnest efforts.

MR. MCCALL: I ask that my motion be put on what I suggested.

MR. HERRMANN: What was it? That a rising vote of thanks be offered?

MR. MCCALL: Yes.

(Whereupon Mr. Herrmann declared the same carried unanimously.)

Mr. McCall: I think we ought to rise two or three times in succession in order to do justice to our retiring President.

Mr. Wilkins: I think the thanks of this Society are due to the committees for the very effective work they have performed and I move that a rising vote of thanks be extended to them.

The President: It is moved that a vote of thanks of this Society be tendered to the Standing Committees for the very efficient manner in which they have discharged their duties during the last year. All in favor of the same, manifest their vote by saying aye, and the noes, no.

Which motion was carried unanimously.

The President: I wish to say at this time, gentlemen, that that expression has not been deserved any better by any officials in your Society than by those gentlemen and by the earnest work of your committees, and I hope the committees hereafter to be named will follow in the footsteps of those who have finished their labors at this session.

They have taken hold of the work in earnest and given a great deal of time and study to the subjects assigned to them, and the papers which were submitted at this meeting and will be submitted to-morrow are an indication of what they have accomplished and the amount of labor they have put into them.

(Calls for Mr. Kerr.)

The President: I regret to say I do not see with us the Second Vice-President just elected.

In fact it may be perhaps a little improper for me to say so, but I cannot help saying so. I am sorry there is not a Chicago representative here of our Society.

I call upon the Third Vice-President, Mr. Adam, of Newark, N. J.

Mr. Adam: I thank you for the honor you have conferred upon me and I do not think that I can add much more upon the remarks as to the ability and the efforts of this Society in attaining and achieving the points laid out by us, and I will give my utmost support to my higher officers in any work for which they may call upon me.

The President: Gentlemen, I know you would like to hear from our Secretary. He is a quiet, unobtrusive sort of fellow. He does his work and performs the duties of his office quietly and is not heard from otherwise than in the performance of his duties, and I think upon this occasion we ought to ask him to say a word or two.

Mr. Fulton: Mr. President and Gentlemen of the Society: I desire to thank you, in the name of the city which I represent and myself, for the honor which has been conferred—not alone upon myself but my city—in electing me again to the office of Secretary of this Society; and, as our President has said, I do not do very much talking myself; in fact, I cannot talk.

I believe I fully realize the work this Society has started out to do, and has been doing for the last two years, this being the third convention, and I wish to be able to do something to continue it in its present course, so that when the years roll on and the work of this Society is represented by legislation in all of our cities, I will feel that my duty has been done. I believe that it has been said here to-day that almost all of us are for different ways of doing things. Of course we cannot all have the same plan, but in the matter of united legislation that might be brought forward we can all help, and for that reason I will do the very best I can for the interests of this Society.

I again thank you.

Mr. McCall: Mr. Pesident, I move that we give to our retiring Secretary, although reëlected to that important office, the thanks of this Society for what he has done, and hope that he will keep straight on in the line he is pursuing and I am sure we will all stand right by him and give him the right hand of fellowship.

The President: All in favor of the motion proposed by Mr. Call will signify by saying aye. All against, no.

THE PRESIDENT: The ayes have it. Mr. Fulton: I hereby tender you the unanimous vote of thanks of the members of the Society here assembled. What you have heard shows you the opinion which I and they have of you.

MR. FULTON: I thank you.

THE PRESIDENT: Gentlemen, we have with us our Treasurer, who has paid every bill which has been rendered to him and still has had money in the treasury.

Not only that, but I understand when he came here before the Finance Committee he not only presented his books but presented a certified check for the balance of the funds; that, gentlemen, is the manner in which the business of the Treasurer's office should be done.

I call on Mr. Kennedy, of Nashville, Tenn.

MR. KENNEDY: Gentlemen of the Convention: When a year ago you saw proper to put upon me the duties of Treasurer, I felt very much flattered by the election; and now, after a year's service, that you have seen proper again to commit to me the important duties of this office, I beg to assure you that I feel profoundly grateful for this kind expression of your confidence.

In the future I will endeavor, as in the past, to keep your accounts correctly, and with the assistance of our members and our very efficient Secretary I have no doubt I will be at the next meeting, a year hence, with a balance to our credit in some safe banking institution.

Again, gentlemen, I thank you for your courtesy.

THE PRESIDENT: Gentlemen, the next order of business will be the selection of the next place of meeting and, having appointed a committee to look into that matter, I call upon Mr. Sherrerd, the Chairman of that committee, for his report.

MR. SHERRERD: Mr. President and Gentlemen of the American Society of Municipal Improvements: The committee appointed by you on selection of the place where we are next to meet has had handed to it several invitations from the officials of different cities, from three or four, asking that their city be selected as the place of meeting for the next convention of this Society.

Perhaps it would be well to read these letters to show the terms in which the invitations are given. The letters are as follows:

CHAMBER OF COMMERCE,
NASHVILLE, TENN., SEPT. 25, 1896.

MR. D. L. FULTON, SECRETARY AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS, ALLEGHENY, PA.:

Gentlemen: The Chamber of Commerce of Nashville, Tenn., together with other official bodies of this city, beg very respectfully to tender herewith a most cordial and pressing invitation for your association to hold its annual convention of 1897 in the city of Nashville during the pendency of our Tennessee Centennial Exposition, opening May 1, 1897, and continuing six months.

We can assure you a most hearty and cordial welcome, and will use all possible means to make your stay among us pleasant, and we feel sure that the recollections of your visit to Tennessee will be a matter of pleasure both to yourselves and the people of our city.

The many attractions and inducements that our state and city have to offer for the meeting here of the different organizations of the country in our centennial year, 1897, are set forth in part in the accompanying circular. Side trips to any and all points of interest, the many battlefields, Hermitage, Lookout Mountain, celebrated stock farms, etc., can be made in a few hours' ride at greatly reduced rates. Many of the principal points can be reached without charge.

Trusting to have the presence of your association in our city next year, we remain,

Very respectfully,
NASHVILLE CHAMBER OF COMMERCE,
By A. J. HARRIS, President.
A. W. WILLS, Secretary.

OFFICE OF THE MAYOR.
NASHVILLE, TENN., SEPT. 25, 1896.

MR. D. L. FULTON, SECRETARY AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS, ALLEGHENY, PA.:

Gentlemen: I take pleasure in endorsing the invitation extended by the Chamber of Commerce to your honorable body to hold your next annual convention in this city during our centennial year. We will see that you receive a most cordial, hearty greeting, and that your stay shall not only be pleasant, but profitable to each of you.

Yours respectfully,
WM. M. McCARTHY,
Mayor.

OFFICE OF THE MAYOR.

NASHVILLE, TENN., SEPT. 25, 1896.

MR. D. L. FULTON, SECRETARY AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS, ALLEGHENY, PA.:

Gentlemen: The City Council of Nashville, Tenn., begs most heartily to unite in extending a most cordial invitation to your association to hold its annual convention in Nashville during our centennial year, 1897, We will receive you with open arms.

Respectfully,
NASHVILLE CITY COUNCIL,
By A. S. WILLIAMS, President.

TENNESSEE CENTENNIAL EXPOSITION CO.

NASHVILLE, TENN., SEPT. 25, 1896.

MR. D. L. FULTON, SECRETARY, ALLEGHENY, PA.:

Dear Sir: As representatives of the daily press of Nashville, we join most cordially in inviting your association to hold its next meeting in this city. We will gladly publish all proceedings of your meetings, and will extend such other courtesies as are usually due from the press on such occasions.

THE AMERICAN,
By JNO. V. BURCH, Gen. Manager,
THE BANNER,
By E. M. FOSTER, Bus. Manager.
THE SUN,
By A. L. ROWE, Bus. Manager.

TENNESSEE CENTENNIAL.

NASHVILLE, TENN., SEPT. 25, 1896..

MR. D. L. FULTON, SECRETARY, ALLEGHENY, PA.:

Gentlemen: The Tennessee Centennial joins most heartily in the accompanying invitations, and will be greatly pleased to have you visit our beautiful city in 1897.

We propose to hold one of the grandest Industrial Expositions ever witnessed in this country for the purpose of celebrating the one hundredth anniversary of the admission of the state of Tennessee into the Federal Union.

On account of the many conventions to assemble in Nashville next year, we will be able to secure for you a very low transportation rate, and will have the necessary convention hall in which to hold your meetings furnished gratuitously.

We will also take pleasure in arranging excursions at greatly reduced rates, should you desire to visit Lookout Mountain, Mammoth Cave, and other noted places in this vicinity.

We deem it proper to state to you, however, that owing to the large number of associations which will visit us in 1897 we cannot arrange for the entire management of entertainments, programs, etc., prepared for the different conventions, but will aid you all in our power, and have organized a special department for the purpose.

Trusting that you may decide to come to see us, we remain,

Yours very truly,
TENNESSEE CENTENNIAL,
By E. C. LEWIS, Director-General.

OFFICE OF BOARD OF PUBLIC WORKS AND AFFAIRS.

NASHVILLE, TENN., SEPT. 25, 1896..

MR. D. L. FULTON, SECRETARY, ALLEGHENY, PA.:

Gentlemen: The Board of Public Works and Affairs of Nashville, Tenn., joins with his honor, the Mayor, and others, in extending a most cordial invitation to your association to meet in Nashville in 1897.

Respectfully,
BOARD OF PUBLIC WORKS AND AFFAIRS,
Per GEO. W. STAINBACK, Chairman.

EXECUTIVE CHAMBER.

NASHVILLE, TENN., SEPT. 25, 1896.

MR. D. L. FULTON, SECRETARY AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS, ALLEGHENY, PA.:

Gentlemen: Permit me, on behalf of the State of Tennessee, to invite you to hold your next convention in the City of Nashville. The State of Tennessee will celebrate the one hundredth anniversary of its admission into the Union by holding a grand Exposition in the City of Nashville during the spring, summer and fall of 1897.

Our people are making elaborate preparations to receive and entertain all visiting associations, and it is the desire of the people of the state, expressed through me, that the members of your association give us the pleasure of your presence at some time during the continuance of the Exposition.

Yours respectfully,

P. TURNEY,

Governor.

EXECUTIVE DEPARTMENT.

INDIANAPOLIS, IND., OCT. 13, 1896.

TO THE PRESIDENT AND MEMBERS OF THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS, IN SESSION AT CHICAGO, ILL.:

Gentlemen: The City of Indianapolis desires to extend to you, through Col. M. A. Downing, President of the Board of Public Works, a most hearty invitation to hold your next annual meeting in her midst. This city takes pardonable pride in the advancement that has been made in her municipal government during the past five years. Since the adoption of our present charter in 1891, she has put down fifty-nine miles of improved roadways, as against two miles existing at that time. Her sewerage system, under course of rapid completion, is well worthy of attention and study, the plans for the same being those of Rudolph Hering, the well-known expert.

There is a deep and widespread interest among our citizens in the subjects to be discussed. We are sure that your visit to Indianapolis would be both pleasant and profitable, and earnestly hope that this invitation will be accepted.

Very respectfully,

T. TAGGART,

Mayor.

MAYOR'S OFFICE.

NIAGARA FALLS, N. Y., OCT. 13, 1896.

G. H. BENZENBERG, PRESIDENT THIRD ANNUAL CONVENTION AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS, CHICAGO:

Dear Sir: I hereby extend a hearty invitation to your Society to hold their next annual convention in our city. I am sure with improvements, electric and water power, you can have a very interesting meeting.

Yours truly,

A. SCHOENKOPF,

Mayor.

THE COMMERCIAL CLUB.

INDIANAPOLIS, IND., OCT. 13, 1896.

TO THE PRESIDENT AND MEMBERS OF THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT:

Gentlemen: The Commercial Club, an organization representing nearly one thousand of the business and professional men of Indianapolis, cordially extends to you an invitation to hold your annual meeting for 1897 in the City of Indianapolis, and gives assurance that it will coöperate with the official representatives of the city in making such arrangements for your meeting as will best provide for your comfort and pleasure while visiting the city.

We hope that we may have the honor of entertaining your organization in our city.

Very truly,

EVANS WOOLLEN,
Secretary.

TENNESSEE CENTENNIAL.

NASHVILLE, TENN., SEPT. 25, 1896.

MR. D. L. FULTON, SECRETARY AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS, ALLEGHENY, PA.:

Dear Sir: I am grateful for your kind favor of 28th ult. and to know that you will present our invitations to the members of the American Society of Municipal Improvements, and I trust you will do all in your power to get the Society to meet with us during our centennial year. I am sure they will all find it pleasant and we will gladly extend a Southern cordial welcome.

Yours truly,

A. W. WILLS,
Commissioner General.

MR. SHERRERD: The committee in considering this question, while it appreciates very heartily the invitations extended from Niagara Falls and Indianapolis, and while it feels that this Society owes something to Indianapolis, at the same time would say that on account of the first three meetings of the Society having been held in these immediate states, it would be well to recommend to the Society the selection of Nashville, Tenn., as the next place of meeting for the convention; and the committee unanimously recommends Nashville, Tenn., as the next place of meeting for the American Society of Municipal Improvement.

THE PRESIDENT: Gentlemen, you have heard the unanimous recommendation of the committee. What is your pleasure?

MR. DUDLEY: I move that the next meeting of this Society in convention be held at Nashville, Tenn.

MR. MCCALL: And I second the motion.

The President thereupon put the motion to the members assembled in convention and it was unanimously carried.

MR. MUNRO: I could not pass this by, now that I feel very glad for the recommendation of this city as the next place of meeting of this Society and I believe the committee have at heart the interests of this Society. We have all of us had a touch of the hospitality from just across the line, over the Southern, or Mason and Dixon line—some of us got touched pretty hard, by the way—but, gentlemen, most of us would very much like to get into the heart of it and enjoy it and go down into old Tennessee. There is none of us who would not like to go down to where Sheridan and Thomas and those other characters of history fought and bled for their country. We not only get information and get together on municipal affairs, but we are in the midst of historical districts, and, as American citizens, let us go down and see and feel the hearty hospitalities these Southern people extend to us—some are here represented and I believe, gentlemen, the Society will go down there with increased membership—let us go down and give them a helping hand and let them see the practical workings of the Society. I believe if we do go down there next year that we can have a good time and that our meeting will be one of the greatest ever held by this Society of Municipal Improvements.

MR. DUDLEY: Omaha is coming on in 1898 with her claim. She is going to hold the largest State Exposition in history, and I assure you we will be very much in it.

THE PRESIDENT: Gentlemen, so far as the convention of 1898 is concerned, I wish at this time to put in an entering wedge for the City of Milwaukee. (Applause.)

I do not wish to take advantage of my position here at this time, but I would say that I have in my pocket a telegram from the Semi-Centennial Committee of the State of Wisconsin, and also a letter from the Mayor of the city, to do whatever I can to secure the convention for the year 1898 to our city. The hospitality of Milwaukee is well known, as well as the advantages it possesses, and there will be no better place in the United States to meet in. Omaha will therefore please pardon me when I extend the invitation to hold the convention the year after next in the City of Milwaukee.

MR. KENNEDY: I simply rise to say to you that our city (Nashville) heartily appreciates your expressions of approval of the action of the committee in deciding to go to Nashville next year.

We will do all we can to make your visit pleasant and profitable and I do not think that there will be a session of your Society when you will not see Nashville officials and citizenship well represented at the meeting. (Applause.)

There is much more that could be said on this occasion besides expressing my gratitude and the gratitude of Nashville, but I will simply tender my personal thanks to the gentleman from Omaha, Mr. Munro, who has so eloquently set forth the advantages of meeting in our city.

MR. BURKHARDT, Newark, N. J.: I would like to say a word to this Society before we proceed further:

I fail to see a representative here from one of the largest cities in the country, and, I might say, from two or three large cities, and I hope that our presiding officers will do their utmost to secure their coöperation in our future conventions. For instance, I fail to see a representative from the great city of New York and Philadelphia and other large cities of the East, and when we meet again I hope they will be represented and I ask that they be asked to send their delegates to our convention.

MR. FULTON: I desire to say I have written four or five personal letters to different city officials of both New York and Philadelphia, and the only letter I received from either city was from the gentleman who is at the the head of the Free Bath Commission of the City of New York.

THE PRESIDENT: We may not have a representative of New York, but we have a representative here from Greater New York, Mr. Lewis, of Brooklyn.

This noon, for the purpose of expediting business, I interrupted the line of business that had started at that time and promised that I would take it up here after; but I want to take this opportunity to introduce to you our Mayor of Milwaukee, Mr. Rauschenberger; I see he is present and I wish to take this opportunity to present him to you.

(Upon Mayor Rauschenberger's stepping forward to the platform, he was greeted with loud applause.)

THE HONORABLE MAYOR OF MILWAUKEE: Mr. President and Gentlemen of the Society: I knew that my friend, Mr. Benzenberg, was just mean enough to call on me in the evening to make a speech, because he knows my speech-making hour is generally in the morning. I knew he would do this.

Gentlemen, I heard here to-day that your Society is yet in its infancy, but from what I have learned this morning, from your transactions and reports of your committees, I will say that it is my opinion that this Society has a great future, and it should have a great future, as you will certainly get the support of the best and ablest men of all city governments. What your Society will do for the tax-paying public in all the cities of the United States cannot be overestimated. I do not think there is one of you gentlemen here, no matter how well you are acquainted with public affairs, that will not add to his experience by attending the meetings of your Society. What you can do and what you will accomplish certainly depends upon the encouragement your Society receives. It ought to be encouraged, not alone by the Mayor of every city, but let me suggest, Mr. President and gentlemen, it should be encouraged by every member of the councils in the country. (Cheers.)

I have not known what sort of business you transacted, but what little I have seen and heard this morning convinces me that you should have that support I have alluded to. I believe, gentlemen, that while you have your minutes printed, that an effort should be made by each and every one of you to induce the members of your councils to get the proceedings of these meetings; they would be of even more value to them than what they are to you. It would make them acquainted with the questions that they have given but very little attention. It would give them an opportunity to legislate intelligently on questions in which the public to-day is greatly interested.

The questions of electric lighting and of paving our streets, especially the latter, is one that is before the tax-paying communities of each and every city in the country. It is, therefore, of the greatest importance to get information on these questions. I have learned a little on those questions to-day, and I will say right here that I will request your President to see that I get a copy of your proceedings, which I will study with much interest. (Applause.)

Gentlemen, I thank you.

THE PRESIDENT: The Mayor of Fort Wayne, is he present with us?

(No response.)

THE PRESIDENT: We have with us the Mayor of Bridgeport.

(No response.)

I know we have with us to-night the Mayor of Chillicothe, the first capital of the State of Ohio. (Loud cheering.)

THE PRESIDENT: I have the pleasure of introducing to you, gentlemen, the Mayor of Chillicothe.

MR. WADDLE: Gentlemen, there is one thing that, no matter where I go, I am always proud of, and that is that I am an Ohioan. I am especially proud of it to-night, because, as I have learned to know my splendid associates in this Society, men of whom any community might be proud, I have found that many of them claim as their birthplace the grand old commonwealth of Ohio. I am proud of it because one of our great citizens, the best municipal officer in Ohio, has been selected here by you as your chief officer—your new President, Mr. Herrmann.

The Mayor of Chillicothe, gentlemen, is like the poor, he is always with you at the time of one of these meetings. I was at the first in Buffalo and came home with my brain fairly teeming with new ideas, new inspirations for my work; I was at the second, when we tasted of the magnificent hospitality of Cincinnati; I am here in Chicago and, if the Lord spares me, I will be with you next year at Nashville.

The advantages of this Society, I find, are not so much to the larger cities of the country, to New York, Boston, Philadelphia and Chicago. Their prestige and almost inexhaustible resources inevitably attract to them the brightest minds and the best methods; it is upon the communities of smaller proportions that this organization confers its greatest favors. By coming here we get a touch of that new life which is pulsating through the great municipalities of America; we can sit at the feet of those who have accomplished great things, and gather inspiration to successfully overcome the little things with which we have to contend; by counselling with those whose lifework has been among the myriad departments of a metropolis the results of our inexperience vanish and problems, which have baffled us for years, become the veriest A B C.

There is no more educating influence to be found for city officers than that afforded by this Society. Last year, at Cincinnati, I had with me the majority of the official roll of my city; this year I have every one of them; and next year I want to bring with us a delegation of public spirited citizens, that we may bear back with us to my old town something of the spirit of progress so manifest in this organization.

Gentlemen, I want to thank you for your attention.

THE PRESIDENT: Gentlemen, I understand we have with us in this convention a representative of the mayor of the first city in which this Society met—the birthplace of this Society, which so kindly extended an invitation to us, and which was the first city to recognize the utility of this Society. I call upon Captain Drake, of the City of Buffalo.

THE PRESIDENT: I have the pleasure of introducing to you Captain Drake of the Board of Public Works of the City of Buffalo.

CAPTAIN DRAKE: Mr. President and Gentlemen: I am afraid the Mayor of the City of Buffalo has but a sorry representative here to-night. Members on the Board of Public Works are usually selected for their ability to do hard work, as I understand it. Any one that can labor can fill the position of the Commissioner of Public Works, while the Mayor, of course, must be a person who can get up and make a speech.

Now, I never expect to be a Mayor, for that is one of the things I can not do. I will simply content myself by saying that I have been in the municipal harness for a good many years, and I am not ashamed to say that I was an alderman for twelve years and know something of the needs of municipalities, and I believe that this Society is moving in the right direction to bring about a better state of things, to correct many errors and to protect the interests of the taxpayers. I have been very much interested in the papers which have been read here and I know and am satisfied that our City of Buffalo can not help but be benefited thereby.

We have nearly 200 miles of streets paved with asphalt, and you that have had any experience in that kind of paving realize the necessity of getting the very best article and caring for it in the very best manner possible, and the only way one can arrive at these matters is to brush up against each other and compare notes and arrive at conclusions in that manner.

It is equally as important in the other matters, in the opening of streets, the building of sewers and electric lighting. We believe to-day we are paying 50% more for the cost of our electric lighting than we should, and by investigating the prices paid in other cities and listening to the statements here that opinion has been confirmed this day—and so it is all through.'

I venture to say, however, that interest, that added interest, will be found in this Society, and that great benefits will be derived therefrom. I thank you, gentlemen.

THE PRESIDENT: The next order of business is the receivign of volunteer papers.

Mr. Secretary, have any volunteer papers been handed in?

THE SECRETARY: No, sir, not that I know of; at least, they have not been handed to me.

THE PRESIDENT: I have been informed, gentlemen, that the Society is expected to vacate this room after the morning session to-morrow, so that the same may be prepared for the evening's entertainment. If it is your pleasure, in order to expedite the work of the Convention, the next order of business set for 9:30 to-morrow may be taken up and proceeded with as far as you think advisable, or else adjourn at this time. To-morrow morning we have the reports of two committees upon the subjects assigned them and seven papers.

In the afternoon we have the reports of two committees, with at least two papers to be read.

If we are to vacate this room to-morrow afternoon we will have to adjourn to the club room at the Great Northern hotel. I will see that we get as many chairs in there as possible, and I think everybody who will attend to-morrow afternoon's meeting can be accommodated. I am sure we can accommodate the number here now, so that there will be no inconvenience to the Society. What is your pleasure, gentlemen?

It being moved by Mr. Dudley, and duly seconded, that the meeting do now adjourn until the following morning, the President put the motion, which, being voted upon, was declared duly carried and the Convention then and there duly adjourned until 9:30 A. M. Friday, Oct. 16th, 1896.

FRIDAY, OCTOBER 16—MORNING.

The Convention was called to order at 9:30 A. M. by President Benzenberg.

The President: Gentlemen, the hour for the morning session has arrived, and I will now call this convention to order, although I regret very much to see so small a number present. Yet the amount of work that is before the Convention to-day necessitates our going on with the work. The first order of business is the report of the Committee on Sewers and Sanitation by R. C. McMath, St. Louis, Mo., Chairman.

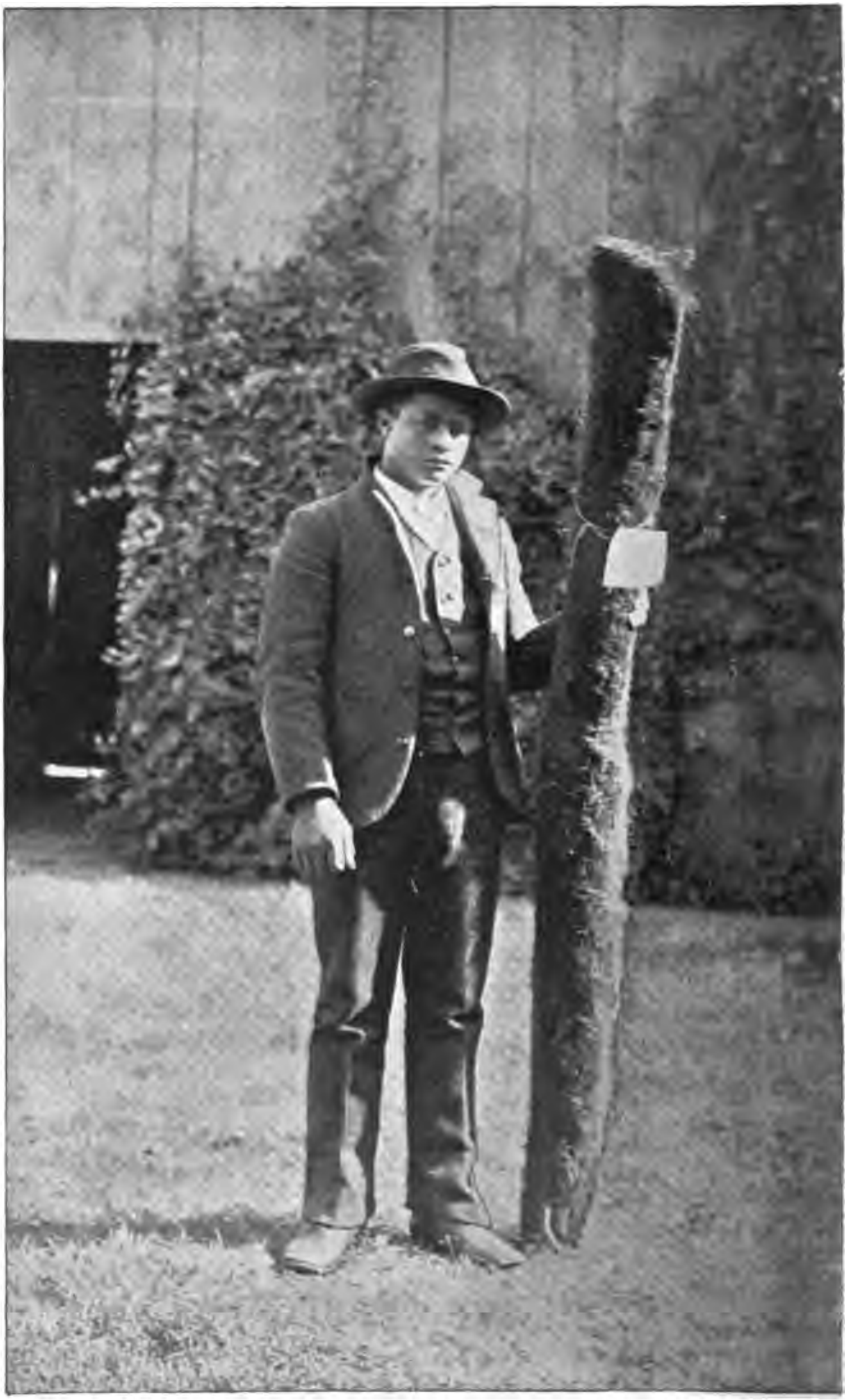
Mr. McMath: The Committee on Sewerage and Sanitation has no formal report to make at the present time. We thought that, having secured the promise of two papers, they would be a sufficient presentation of the subject. Mr. Claussen is not in the room at present. I have the pleasure, however, to say that Captain Beach, of the Corps of Engineers, is ready with a paper, and that he will present it, and I am still in hopes that Mr. Claussen will be here on time to present his paper on the disposition of sewage in Chicago. If he does not come, I will present a little matter myself later on.

Capt. Lansing H. Beach then read the following paper:

THE CONSTRUCTION OF PIPE SEWERS AT WASHINGTON, TO PREVENT ROOT INTRUSION.

BY CAPT. LANSING H. BEACH, CAPTAIN CORP OF ENGINEERS,
WASHINGTON, D. C.

The width of Washington streets and avenues, as great as 160 feet in some cases, and the expensive asphalt pavements so largely used, have forced many sewers to take the form of a double line, one branch in each sidewalk, instead of a single line in the axis of the street. There were no through alleys in the plan of the city when it was laid out, and it is only in exceptional cases that houses can be drained to the rear. The sewers are, therefore, forced into the streets and must, in many cases, be in or close to the sidewalk. The fact, however, that there is a portion of the street, termed the parking, varying from 12 to 40



TREE ROOTS FROM SEWER PIPE.

feet, between the houses and the sidewalks, renders the placing of sewers beneath the latter much less objectionable than it would be in most other towns.

Washington is provided with more shade trees than ony other city of the country, perhaps than any other city of the world. The setting and care of these is a matter entirely controlled by the Commissioners governing the city, the individual having no more right or privilege to plant trees than he has to lay street pavements. Streets are provided with shade trees at the time the curb is set, each having but one variety of tree throughout its length. In can, therefore, be readily seen that, as the trees are set just inside the curb, sewers in the sidewalks are particularly exposed to the action of roots, and where not carefully laid become in a few years completely choked. The accompanying illustration shows a mass of roots taken from an eight-inch pipe.

Prior to 1878 but little care was taken to secure tight joints in laying a sewer, and as a result it has been necessary to take up and relay many of these lines, and it is probable that all laid before that date will eventually have to be replaced. To cut down the shade trees as has been done in some cities would be cheaper, but is a method that would not be permitted by congress or the people of the city. In 1878 the trouble from roots having begun to be a serious question, it was determined to lay the sewers in concrete, covering each joint with a concrete band. Burnt clay rings similar to the pipe were used at first to cover the joint beneath the concrete, but of late years these have been abandoned, as it was found that the concrete band alone was cheaper and better. Only three instances are known where the sewers laid in concrete have been troubled by root intrusion and upon uncovering these sewers it was found that in each case defective work was distinctly the cause. Two of these sewers were by contract, one was by day's labor. The method with this showing after eighteen years of test is certainly efficient, and it is believed to be the cheapest construction that will secure the desired result.

In order to give a description that may be fully understood of the work of building these sewers, a brief outline of the office methods will be first stated. Plans for sewers are prepared in the office of the Superintendent of Sewers. The sewers in the city being upon the combined system, the quantity of rain water which any one will have to carry and its gradient control its size. To determine the volume of water the empirical rule has been adopted, and a sewer draining an area of 10 acres or less must be capable of carrying an amount equal to 3 inches per hour reaching it. For areas of 60 acres or over the formula $Q\ 5.29375\ A^{3/4}$ is used. in which Q is the number of cubic feet per second to be carried by the sewer and A is the area in acres; this corresponds to an amount of two inches per hour reaching the sewer; for areas between 10 acres and 60 acres the quantity of discharge is assumed to vary proportionally to the area.

For determining the grade and size of sewer, the formula

$$V = \frac{(180\ 99\ s^{\frac{1}{2}} + .002907\ s^{\frac{1}{2}})\ R}{.5415^{\frac{1}{2}}\ s + .00003649 + S\ R^{\frac{1}{2}}}$$

is used, which is practically Kutter's formula with n .013. A graphical table was prepared some years ago, showing the relation between grade and size of sewer and velocity and quantity of flow, and is used in computations. In this table the abscissas vary according to the law of square roots, with the result that the line representing each size of pipe is a straight line, with corresponding greater accuracy of position and intersection of coördinates than would be the case were the abscissas to vary according to the natural numbers and the size of pipe be represented by a curve constructed by points. The table also shows the drainage area furnishing the quantity of water carried by the sewer in units of 10,000 square feet.

The plan for the sewer, including such drawings as may be necessary and an estimate of its cost, is then forwarded to the officer in charge for his approval, and is by him sent to the Engineer Commissioner of the District; if approved by him and ordered by the Board of Commissioners the papers are returned through the same channel to the Superintendent of Sewers, who assigns the work to one of the assistant engineers, who locates the line upon the ground, giving stations every 50 feet, with the depth of excavation to the bottom of the interior of the sewer at each.

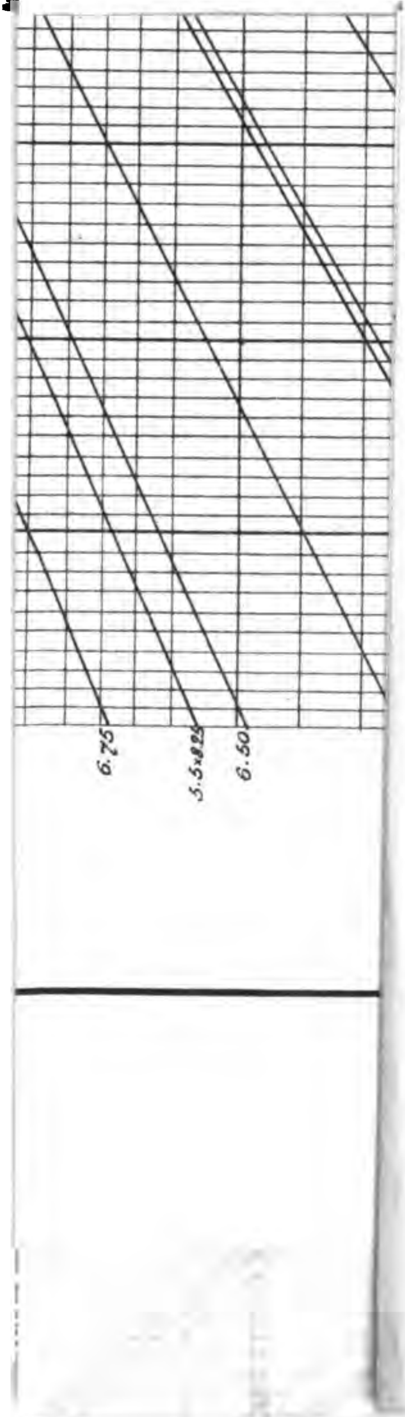
For pipe sewers a table, giving the quantity of material per 100 feet for each size, has been made, and is as follows:

MATERIALS REQUIRED FOR CONCRETE FOR LAYING 100 LINEAR FEET OF PIPE SEWER.

Proportions, 1: 2: 4.	24-in. diam.	21-in. diam.	18-in. diam.	15-in. diam.	12-in. diam.	10-in. diam.	8-in. diam.
Cement, unit-barrel.	19.14	17.16	14.77	12.79	10.58	9.14	6.76
Sand, unit-cubic yard......	5.85	5.25	4.52	3.92	3.23	2.79	2.07
Pebbles, unit-cubic yard...	11.70	10.49	9.04	7.83	6.47	5.59	4.16

Note. Pebbles and sand increased 10 per cent. for waste.

A requisition upon the Superintendent of Property for the estimated amount of material necessary for the sewer, naming the locality of the work and appropriation to which chargeable, is then made out by the Assistant Engineer, and after being approved by the Superintendent of Sewers is sent to the Accounting Clerk of the Engineer Department,


6.75
5.5x8.25
6.50

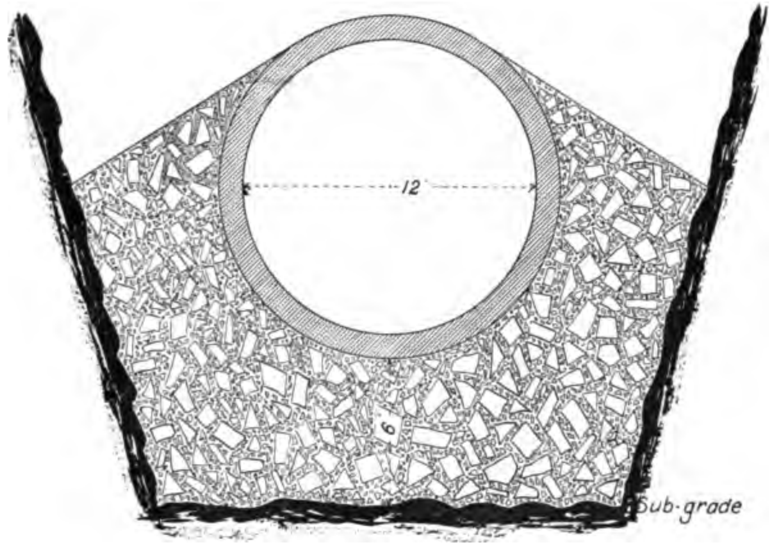
who is entirely independent of the division of sewers and plumbing; this clerk verifies the fact of the work having been ordered by the Commissioners and enters the items with their money value upon his books and notes these facts upon the paper. It then goes to the officer in charge for his approval and after that to the Superintendent of Property. He enters the requisition upon his books and draws an order for the material upon the property yard which has the articles or that one which has the shortest haul and gives the order to the foreman in charge of the work, who presents it at the yard upon which it is drawn. The hauling is done by the carts engaged upon each job and at such times as will be to the advantage of the work and not cause obstructions in the streets. The foreman gives the property-yard-keeper a receipt for each load hauled. The amounts hauled and destinations are reported to the Superintendent of Property at the end of each day and the receipted tickets inclosed. Upon issue of all the property or completion of the job the order is indorsed by the yard-keeper and returned to the Superintendent of Property, who reports the amounts actually used to the Accounting Clerk and Superintendent of Sewers, to be charged into the cost of the work. In case material hauled for a work remains over it is carried by the foreman to the next locality, being credited to the first work and charged to the second, as if it were an issue from the yard. If the material ordered proves insufficient, a supplementary requisition for the necessary amount is made. No material whatever is allowed to leave the property yards without receipt.

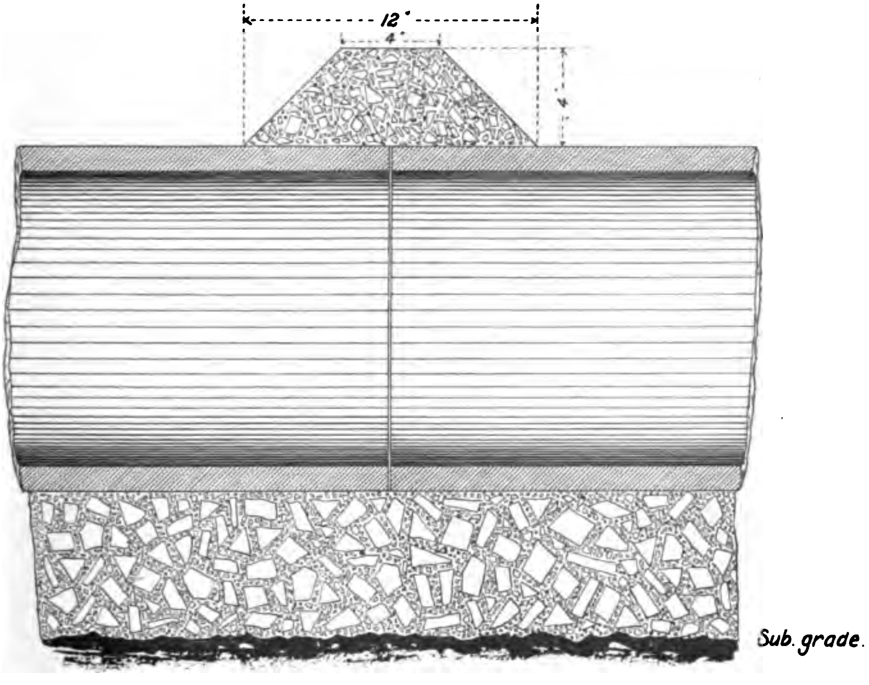
The same method is followed in furnishing material to a contractor, except that the contract specified value of such issued material, except pipe and manhole irons, is charged against him and deducted from payments made to him.

The trenches for pipe sewers are ordinarily from 2½ to 3 feet wide with headers of about 2 feet in width at intervals of about 10 to 16 feet, these headers being tunneled through 3 or 4 feet above the bottom. The stations given by the Assistant Engineer are always left in a header. The foreman erects a stout stake at each station and marks on it, at a convenient distance above the ground, an orbitary number of feet above the bottom of the interior of the sewer, this number of feet being the same for all the stations; a cord is then stretched from stake to stake at the marked point, and is therefore parallel to the bottom of the sewer. Foremen are required to keep this cord stretched across four stations, or for a distance of 150 feet, thus giving an opportunity to detect any error. Measurements to the bottom of the trench are then easily made by means of a graduated pole of plumb-bob line. When the trench is to the required depth, 6 inches of concrete is spread over the bottom and well rammed with iron rammers of about 18 square inches striking surface, weighing 16 pounds, and wooden rammers of 1 foot square striking surface and 4 inches thick, with wooden handle. The concrete is made in batches of 1 barrel natural cement, 2 barrels sand, and 4 barrels gravel, and is mixed by a gang of eight men, as follows:

The cement is turned upon the mixing platform, which measures 12 feet by 16 feet, the sand is then added, and the men, working two on each side of the platform, turn the mass with shovels from the center into four piles at the corners, then back again to the center until it is of a uniform color; it is then spread out about 2 inches thick and the gravel spread evenly over it; water is then added and the gravel and mortar thoroughly incorporated by turning from the center to the corners and back as before. Hoes are sometimes used in mixing, but for continuous work the men appear to prefer the shovels. One contractor began a year or two ago to use a hoe in which two holes each about 2 inches in diameter have been cut in the blade; this greatly facilitates the mixing of mortar, both as to time and force expended, and has been largely adopted by other local contractors. Ordinarily the mixing gang helps place the concrete, the time of mixing and placing averaging thirty minutes per batch. If a gang mixes steadily it can make a batch every fifteen minutes. Gravel is found to be much better for sewer purposes than broken stone, for several reasons: It mixes more readily, the average time for making a batch with stone being nineteen minutes; it can be rammed quickly and also much more compactly in the quantities used, thus giving a cheaper and better product. Better results are obtained by adding the water after the gravel is placed upon the mixed sand and cement than by adding the gravel to a mortar of the other materials, for in addition to the saving of time it is found that if the mortar is mixed first it has a tendency to ball up and form into lumps, and is not so uniformly distributed throughout the pebbles. With broken stone slightly better results are believed to result from mixing the mortar first The preparation of the ingredients is done by the mixing gang.

After the concrete has been brought to the required depth, as determined by the rod and cord, the pipe is lowered and placed in position, each section being tested for grade by the rod, which has a projection of about an inch in length upon its lower end for this purpose, allowing it to enter the pipe and the measurements to thus be made from the bottom of the interior; to measure from the top of the pipe would not insure an even surface along the bottom. For alignment the pipe is tested by a plumb-bob whose string is held against the cord. The pipe being properly bedded, concrete is lowered in buckets, care being taken to empty the first three or four on the axis of the pipe, the concrete


12"
6
Sub-grade


12"
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Sub. grade.

falling to the sides, it being found that if the bucketful is placed in at one side there is danger of displacing the pipe laterally. After four or five inches have been placed in this manner the concrete is worked against the pipe by a shovel or trowel, and when about six inches has been put in it is well rammed; after being brought up slightly above the horizontal diameter, bands of concrete are placed over the joints, as shown in the drawings; it being impossible to ram these bands without displacing them, they are compacted as much as possible with wooden paddles and heavy trowels made of five-sixteenths-inch iron. Where possible the concrete is allowed to remain twenty-four hours before any earth is filled back into the trench. The interior of the sewer is always examined to see that no mortar has been forced through the joints so as to form a projection or obstacle to the flow of water.

Contractors upon pipe sewers are required to follow the same methods, the inspector setting the cord.

All sewer work exceeding $1,000 in cost is required by law to be done by contract after advertisement. The effect of this is practically to cause all large brick or concrete sewers and the longer lines of pipe sewers to be built by contract, leaving only the shorter lines of pipe sewers to be constructed by hired labor. The contractor is required to use the cement, vitrified brick, invert blocks and pipe funished by the District; other material he provides himself, subject to the District specifications for quality. On the smaller sewers the contract price is usually for the linear foot of completed sewer; on the largest sewers the contract is generally by the cubic yard of material in the sewer. All contractors are required to make eight hours a labor day. Inspectors are paid $4 per day, the amount paid them being included in the cost of the sewer upon which they are engaged.

In all work done by hired labor the day is of eight hours; ordinarily from 7 a. m. to 12 m., and from 1 p. m. to 4 p. m., but in late fall and early spring, work begins at 7:30 a. m., with half-hour intermission at noon time. The wages paid are all by the day and are as follows: Foreman. $4; laborers, first class, $1.75; second class, $1.50; masons, and bricklayers, $4; watchman, $1.50; water boys, 50 cents, two-horse wagon with driver, $3.50; one-horse cart with driver, $1.75. The foreman is responsible for all tools belonging to the District used by his party, and for all material issued for use in construction of the sewer, and that all work is properly performed. The first-class laborers are generally those engaged at the bottom of the trench, where the throw is hardest, and in mixing and handling concrete.

The materials used in all sewers built by hired labor are purchased by the District in large quantities by contract and stored in the District property yards. The yards are five in number, adjacent to the railroads or water front, and each contains the material which can be placed in it with the least haul from the point of unloading, as a rule such hauls being less than 500 feet. The prices paid during 1895 were as follows: Concrete sand, per cubic yard, 47 cents; screened sand for brickwork, per cubic yard, 69 cents; gravel, per cubic yard, 75 cents; sewer pipe, per foot, 6-inch, 4½ cents; 8-inch, 6¾ cents; 10-inch, 10 cents; 12-inch, 11¼ cents; 15-inch, 18½ cents; 18-inch, 26½ cents; 21-inch, 40 cents; and 24-inch, 49 cents; Y branches, each, 30 cents, 41 cents, 46 cents, 75 cents, $1.13, $1.63, and $2.08, respectively; invert block, per linear foot, 40 cents; vitrified sewer brick, per M, $16.50; hard arch brick, per M, $6; natural cement, per barrel, in sacks, 79 cents; in barrels, $1; Portland cement, per barrel, in barrels, $2.12.

Under these prices for material and labor the cost of the different size sewers per linear foot was, during the past year, as follows:

By hired labor, 8-inch pipe, $1.18; 10-inch pipe, $1.09; 12-inch pipe, $1.25; 15-inch pipe, $1.64; 18-inch pipe, $1.86; 21-inch pipe, $2.07; 24-inch pipe, $2.81.

By contract, 15-inch pipe, $1.76; 18-inch pipe, $1.97; 21-inch pipe, $2.19; 24-inch pipe, $2.60.

The sand used is of exceptional quality, being a nearly pure silica of sharp, regular grain, obtained by dredging in the Potomac, and is delivered in a condition that would be termed "washed" in most localities; two sizes are used; the coarser for concrete and the finer for brickwork.

The gravel is used for concrete. Broken stone, at $1.50 per cubic yard, was formerly used for this purpose, but the saving in purchase price by using gravel, as well as its other advantages, have caused it to be employed exclusively in the department. All pipe larger than 8-inch is of the ring pattern, that is, without bell ends. It is found that the bottom of the sewer, with this pipe, can be made much more even and free from projections due to irregularities of circumference. The timber used for braces and shoring is Virginia pine, costing $13.50 per 1,000 feet, and can be ordinarily used about eight or ten times.

This method is the work of some of my predecessors in office and Mr. D. E. McComb, who has been Superintendent of Sewers in the District of Columbia for many years.

MR. ADAM, Newark: May I ask Captain Beach, of Washington, how much the increase in cost is to provide for a concrete foundation under the pipes and with this sleeper under—what that would actually increase the cost of ordinary pipe-laying without a concrete base?

Captain Beach: I do not know that I can answer that accurately. Concrete costs about $4.40 a cubic yard in the trench complete. Now, then, there is six inches under the pipe, the trench at the bottom for a twelve-inch pipe would be two feet wide; that would make about one cubic foot a running foot of sewer, and that would be about one-twenty-seventh of $4.40 per foot.

Mr. Adam: That would be excavation, too, with the six-inch concrete foundation. I thought perhaps Captain Beach had figured what the approximate increase of cost was per linear foot.

The President: We will take up the next paper before we will join in the general discussion on this subject. The next paper is "Sewage Disposal in Chicago," by Mr. G. L. Clausen, Superintendent of Sewer Department, Chicago, Ill.

Mr. Clausen then read the following paper:

SEWERS AND SEWAGE DISPOSAL OF CHICAGO.

BY G. L. CLAUSEN, CHICAGO, ILL., SUPERINTENDENT BUREAU OF SEWERS.

Among the many and difficult problems presented in a rapidly-growing city and question of sewage has been a most important one in Chicago. The early engineers have shown great ability and wisdom in starting the right system, and enable Chicago of to-day to build cellars and basements, when it be borne in mind that the land upon which the business portion of the city and also quite an area of adjoining residence parts were nothing more than a slough or wet prairie. How these men could have convinced the people that it would be necessary to raise the city from eight (8) to ten (10) feet above the natural prairie, and build the sewers accordingly, when there was not a single shovelful of dirt to spare within its boundary and for miles outside thereof, is something worth considering and worth admiring, as we undoubtedly all know how tempting it is to yield to the pressure of parties whose main object may be to please the people of to-day, and let the future generations take care of themselves. Think what a calamity it would be for a city to find that, because it has grown beyond its size, its underground work is inadequate, and must be ripped up and rebuilt, and in so doing disturb all surface work and improvements made. The city of Chicago has very litttle trouble with the sewers constructed in the early days. The business portion which is filling up with twelve to sixteen-story buildings, may cause some trouble, and it may be necessary in time to rebuilt these sewers, but I do not think we can blame the engineers of thirty to fifty years ago for not planning their sewer systems for "sky-scrapers."

The problems presenting themselves in designing of sewers, and the sewage disposal of Chicago, are difficult ones, mainly because of the level surface and its low elevation above, Lake Michigan; as stated above, the business portion of the city and also the adjoining residence portion for, say, one to two miles adjoinng is raised from six to ten feet above the original surface by means of building area walls at both curb lines of the streets, and building the sewers at or near the original surface and filling in the streets by degrees from the excavations from cellars, etc. The prairie outside the original low lands around the Chicago River rises gradually and by adopting flat grades for our sewers we obtain in mostly all places sufficient covering to avoid filling. The Chicago River with its two branches to the northwest and southwest forms a convenient dumping place, or our so-called outlet, for all parts of the city excepting that portion bordering on Lake Michigan, and also excepting the forty-nine square miles of territory formerly known as "Hyde Park," now a part of the city, so that about 75% of our sewers empty into the Chicago River, and all of these are gravity sewers taking care of the sewage and storm water, and we experience very little trouble in keeping them clean, notwithstanding their flat grades.

Up to about ten years ago, all the sewers of Chicago were gravity sewers, and the idea adopted by our early engineers of filling in the land whenever it was too low has been followed. In the meantime, Chicago grew very rapidly and began annexing the suburbs and among them Hyde Park south of the old limits. The village of Hyde Park had sewered its territory previous to the time of annexation as far south as the north line of the World's Fair ground, by means of gravity sewers emptying into Lake Michigan, as the land north of the Fair ground is high enough to be drained, but from that point south the land falls off quite rapidly toward Calumet River and becomes too low to be drained by gravity sewers without filling, and, at the same time, the territory was rapidly building up with the best class of houses, in many cases rich or well-to-do people having bought the land and began building their homes without being aware of the fact that the land must be raised in order to sewer it, so when the time had come for building the sewer system, the people refused to have the land raised; well, in fact, it could not be raised without working a great hardship on the territory, and it was decided to adopt the separate system of sewers and pump the sewage from the lower system and construct storm water sewers near the surface of ground to drain by gravity into

Lake Michigan. The sewage system with its pumping works was constucted and proved to be a total failure, mainly because of the difficulty in keeping the sewers clean and in running order. When the next territory lying south thereof was ready for the construction of their sewer system, and, profiting by the misfortune of their neighbors, adopted the combined system and taking care of sewage and storm water by pumping. The operating expenses in pumping both sewage and storm water are, of course, higher as well as the first cost of pump-plant, but considering the saving in constructing only one system of sewers, instead of two, also that the same number of engineers and helpers are required in operating the plant, whether it pumps sewage alone or includes the storm. waters, it simmers itself down to a few additional tons of coal per year, which is a small matter, considering the advantage of being able to keep the sewers clean and in good working order. This system has given satisfaction, and this plan has been adopted for all the lands in the southern part of the city, which are too low for gravity sewers, and an additional plant has since been constructed and has been in operation for some three years with the same result. Another similar district has been laid out and a system planned with a nine-foot sewer at pumping station, draining a low, level territory of ten square miles. This, including out-fall sewer to Chicago River, will cost $1,300,000, and is expected to be built next summer. Centrifugal pumps are used in the combined systems.

We have two districts in the annexed territory which are sewered by means of the separate systems, and ejectors are used. The same trouble exists there, that the small sewers clog up and ejectors get out of order.

The new drainage canal which is expected to be finished in another year will take all sewage out of the Chicago River, across the divide between Lake Michigan and Mississippi River, and give us a much-needed outlet for the City of Chicago, but before the sewage can be finally disposed of and our drinking water be entirely free from contamination, it becomes necessary to intercept all sewers now running into the lake, and, as there are twenty-nine brick sewers flowing into the lake, two of which are low-level sewers built since the Sanitary District was inaugurated, instead of turning same towards the Chicago River, it will be necessary to build some twelve miles of intercepting sewers, varying from five to fourteen feet in diameter, along the shore of Lake Michigan, and intercept all the outlets of such sewers, and, by means of two large pumping stations, convey the sewage to Chicago River, where it will be taken care of by the drainage canal.

The description of the drainage canal has been published in several of our technical papers, and is well known among the engineering profession, so I will not take up our time in a detailed description of same, it being sufficient to state that it connects with the upper end of the South Branch of the Chicago River, and cuts through the low divide between the waters of Lake Michigan and Mississippi River, its elevation being low enough to change by gravity the flow of the Chicago River from Lake Michigan southwesterly through Illinois River and into the Mississippi. This canal will give Chicago a permanent outlet for our sewage and enable us to keep our drinking water free from contamination, and also create a current in Chicago River of such velocity as to dispose of the sewage before pollution has taken place.

The usual fall in our main sewers is 1 in 2,000, giving a velocity of from two to three feet per second, which is sufficient to make them self-cleansing, provided the proper care is taken to keep grease, dirt and other foreign matter away. The dimensions are computed from a rainfall of three inches in twenty-four hours, and it is figured that only half that amount reaches the sewer in our outlaying districts, where a larger part of the ground is taken up by lawns and back yards. No flush-basins are used.

I have purposely avoided details, and have endeavored to outline the Chicago Sewer System in the shortest possible way. I hope, however, that the vital importance of having a satisfactory sewer system in any municipality is such that the experience had in this matter will be brought out in the discussion.

THE PRESIDENT: Are there any members who have other papers to present on this subject of sewers? If not, that subject is now open for discussion. I have no doubt that both gentlemen will answer any questions put to them.

MR. GUTHRIE: I notice that Mr. Clausen said that they have trouble with the ejectors in use in connection with pipe sewers. I would like to ask what form of ejector he has and what is the special trouble that he met with.

MR. CLAUSEN: The Shone ejectors are used. I will say, however, that our experience with the ejectors is not very extensive. We have only two small systems, and, while the ejectors have frequently been out of order and caused us quite a lot of expense and inconvenience in repairing same, the main trouble with these systems is the clogging up of the small sewers. It is possible that in other localities, where you have steeper grades you would not experience such trouble, but as far as Chicago is concerned, and in territory where we have to adopt the minimum grade, the separate systems have proven absolutely worthless. In the southern part of the city you might say a model town is built about twelve to fifteen years ago where the same system was adopted and also the sewage disposal was to take place by means of spreading it on the farm lands. That has been abandoned. The territory lying outside of the World's Fair grounds, that is, Woodlawn territory, where we also have a separate system, we find there that the sewers are constantly clogging up. It may be because of some defect of construction, but it is mainly because of the flat grades.

Mr. Guthrie: I would like to know what the nature of the trouble was with the ejectors themselves.

Mr. Clausen: I am not exactly in position to give the details of the trouble. They are getting out of order and we have to have a constant repair expense in the matter. What the absolute details are I really am not in position to state.

Mr. Pearson, Louisville: May I ask you what the original grade of the city was before you began to fill; I mean its average elevation above the lake?

Mr. Clausen: The business portion of Chicago and also the land lying adjacent to the Chicago River had an average elevation of from 6 to 7 feet. The grade of the city is raised up to 14 and 15. Mostly all the streets around here are fourteen feet above Lake Michigan.

Mr. Pearson: Now, may I ask you one more question. What means have you adopted for cleansing the small sewers in the separate system—the plan just spoken of—the house drainage alone? I have lived here a couple of years and at the time I lived here I noticed that your men very frequently used a long chain that they dragged to and fro through the sewers, but it was a little of a curiosity to me to know how you got them down there.

Mr. Clausen: We have our manholes about 110 to 125 feet apart, and use a number of rods three feet in length, and with screw joints at the ends of the rods; they are about one-half of an inch in diameter, made of wood, and we screw one rod to the other and push them through from one manhole to the other, and after that drag a rope through and after that a chain, and by means of scoops we drag the obstruction from one manhole to another down stream.

Mr. Guthrie: You say the manholes are twenty-five feet apart?

Mr. Clausen: One hundred and twenty-five. Sometimes we use a large flush wagon and we endeavor to clean and force the obstruction by means of flushing. If that works it is the cheapest, but very often you have to work the sewer chains.

Mr. Lewis: I am credibly informed, although I do not know from personal experience, that in many towns in Great Britain a part of the ordinary outfit of a sewer repair gang is a little dog, who has been thoroughly trained, and who is let down one manhole and goes to the next with a small cord fastened to his neck. This cord is increased in size until a chain, wire brush or other appliance can be pulled through the sewer.

Mr. Adam: I would like to ask what the least grade is that you have here.

Mr. Clausen: Three inches to a hundred feet for twelve-inch sewer. We have the same grade on some minor sewers, but that is supposed to be a minimum grade—three inches in a hundred feet in twelve-inch pipes. Of course, we have grades as flat as a half-inch to one hundred feet.

Mr. Adam: Do you have any smaller than twelve-inch sewers?

Mr. Clausen: Yes, we have a few nine-inch.

Mr. Adam: Nothing less?

Mr. Clausen: No.

Mr. Kennedy: You have not a sewer twelve inches in diameter that has a fall of less than three inches in one hundred feet?

MR. CLAUSEN: Yes, the fall of our main sewers is generally one in two thousand; that is, generally one-half an inch to one hundred feet. In fact, whenever the sewers come up to six and seven feet in diameter we prefer to adopt the flat grade of one-half of an inch to one hundred feet, if it is possible. That gives a velocity of over three feet and that is enough.

MR. KENNEDY: What kind of catch basin traps do you use here?

MR. CLAUSEN: We use the half trap basin; it is not a sealed trap; it seals when the basin is working or full of water, and if the water in the basin in the summer time, through leakage or otherwise, comes below the traps, then it does not seal, but is supposed to hold the water down to the height of the highest point of this trap.

MR. PEARSON: Is it a double SS?

MR. CLAUSEN: No, it is a single S (draws diagram). If that is a catch basin, the trap has this shape, so, of course, the water will stand up to this point and level with the trap in the basin. It is a perfect seal as long as the basin holds the water, and we have never experienced any trouble as far as frost is concerned.

MR. KENNEDY: Is not that a water-sealed trap?

MR. CLAUSEN: Well, you may call it a water-sealed trap, but the trap itself does not hold water.

MR VAN DUYNE: Do I understand that all that sewage system has been a failure on account of very slight grades and on account of the clogging up of the system?

MR. CLAUSEN: Here in Chicago we have abandoned the separate systems, because we have had trouble, and the main cause of the trouble, I presume, is our flat grades, because we have not had a separate system which has given satisfaction. Our soil in mostly all the lowlands is quicksand, and the sewers have to be built below the level of Lake Michigan. I presume it is very difficult for us to make the joints absolutely tight, so, being laid very flat, any foreign matters that come into sewers will lie there and clog the sewers.

Mr. Kennedy: What is the size of your pipe leading from the catch basin to the sewer?

Mr. Clausen: Nine inches.

Mr. Adam: What does Mr. Clausen mean by foreign matters coming into pipe sewers?

Mr. Clausen: Sand, or whatever the soil consists of that the sewers are built in.

Mr. Adam: Are not your sewers tight enough to keep foreign matter out?

Mr. Clausen: They are supposed to be, but we find that they are not.

Mr. Adam: Isn't it owing to the fact that on account of the quicksand the sand settles in and prevents the flow in that way?

Mr. Clausen: Yes.

Mr. Stainsby, Newark: The condition of Chicago as to lying flat is a good deal like a portion of the City of Newark. Any one who has ridden through on the Pennsylvania Road will remember there is a large section on the right that is very flat. In fact, it extends over onto the left side as well. You speak about two separate systems for storm water and house sewage. Would you do away with the house sewerage alone, if your house sewerage does not prove itself to be perfectly worthless?

Mr. Clausen: It is always possible to build a combined system.

Mr. Stainsby: I rather think it is too expensive a system to combine the two. We have an intercepting sewer in a portion of our city now that is simply for house sewage, and not for storm sewage. We propose to still continue the intercepting sewer through that other territory, which lies as flat as Chicago, that is right alone the river, and there is a little difference of opinion in our City in the Board of Commissioners, whether there is any use of building that sewer, because it cannot take anything else but the house sewage. It would be an enormous expense to build a separate sewer, because a portion of our city lies high and the water comes down from that into this, and that will fill almost any sewer that we can build, because the fall is so great, and I would ask you the question if you would abandon entirely a house sewerage system, or whether you would retain it?

MR. CLAUSEN: No, I do not think I would if I could replace it with something better.

MR. STAINSBY: We can send our storm water to the river direct. The Commissioners of our City are projecting the building of a number of storm-water sewers, but we cannot throw into this possibly any more house sewage; the river is already corrupt and the health of the City endangered, and we now propose to build another intercepting sewer, and this projected sewer would go into the old interception. The point that I want to ask you about is if the experience of Chicago is such that you would abandon entirely the smaller sewer without you could have both.

MR. CLAUSEN: No; of course, there are cases, and I believe this is one of the cases, where you are almost obliged to separate the two. The conditions are such that it would not be practicable to do anything else, no matter what expense you would have to go to, both the building of the two systems of sewers and also the expense of maintaining the lower or smaller system of sewers, you would be practically obliged to continue the same system, and, of course, I should not think of doing anything else. But the main idea is that the experience that Chicago has had in the different systems of sewers is such that if it is possible to avoid the building of the separate system of sewers it should be done. The main reason for building the separate system of sewers is, in our case, that people were afraid that the pumping of the storm water would be so enormous that it would be out of the question to combine the two. Now, we find that it is not, and we find that the advantages that we have by building a combined system is having our sewers amply large enough to be readily cleaned and also the larger the sewer is the flatter grade you can give it, and we found that the advantages are such that Chicago has for all time abandoned any separate system of sewers. We would rather go to the expense of burning a few tons of coal a year in addition to what we have done and pump both. You must bear in mind that you have the handling of the pumping plant, the engineer and their helpers on your hands anyway; whether they are working half the time or all the time, their salaries go on. The increased cost in enlarging the plant in the beginning is not very vital, because we save it over and over again by constructing only one system of sewers instead of two, and you have very little trouble in the future.

MR. ADAM: Regarding the matter that Mr. Stainsby speaks of the City of Newark has about six square miles of meadow land; there is very little variation at all in its elevation.

This territory that Mr. Stainsby mentioned is part of this meadow land. The people had improved the land and filled up the streets, so that in designing a sewer system for that section we found the same difficulty that Mr. Clausen spoke of, that the people were averse to having the territory filled up to a sufficient elevation in order to insure the proper drainage of that territory. The lowest elevation is about three and one-half feet above high water, and that is about two miles away from the shoreline, and then the City is expected to construct sewers to carry off storm water and house sewage. I am somewhat surprised at Mr. Clausen's statement, that the separate system of sewers is somewhat of a failure, considering that prominent engineers often advise the adoption of a separate system even where there are no flat grades to be contended with. Of course, they may be prohibited from sending the sewage into a near-by stream. In Orange and East Orange they have the separate system, with only a few large storm-water sewers. I have not heard of any difficulty with the smaller sewers for house sewage; I am surprised to hear from Mr. Clausen that the storm-water sewers are designed to carry off but one-half inch in twenty-four hours.

THE PRESIDENT: I wish to say a word on that in order that there may not be any misapprehension. The amount of sewage or dry weather flow is entirely out of proportion to the possible amount of water to be disposed of during the rain storms; hence, in the construction of combined sewers, the dry weather flow does not cut a figure, or is not taken much into consideration in dimensioning the sewers. There is more danger of a cesspool forming, or material lodging in the separate sewers than there is in the storm sewers, unless you have flush tanks all along the terminals. There is no question about the practicability of a separate sewer system taking care of the dry weather flow, or sewage of a city, if proper provisions have been made for a regular, periodical flushing of every branch of that sewer. You can naturally see that in a separate sewer system there is not sufficient liquid to carry the solids along, and, consequently, flushing is absolutely necessary and without which the separate sewer system is a failure from the start. In a combined sewer system the storm water, which discharges at a very rapid velocity, cleanses out any deposits in the sewers. I would like to ask Mr. Clausen the amount of lift above the low-level sewer in the south section of the city necessary to discharge by gravity into the river or lake.

Mr. Clausen: The lift in the present systems that are now constructed is from ten to twelve feet. We are going to commence a system in the spring where we have a lift of twenty-seven feet, the actual elevation between the lower and the higher sewer.

The President: You spoke of constructing intercepting sewers along the lake in connection with a system of connecting your water supply, keeping sewage out of your lake along the front. In consideration of the size of the intercepting sewer, do you expect to take care of dry water flow only, or any part of the storm-water with it?

Mr. Clausen: All the storm-water with it.

The President: What is the maximum size of the sewer?

Mr. Clausen: The largest sewer flowing into the lake now is seven feet in diameter and there are twenty-nine of them, but they vary from two and one-half to seven feet.

The President: What is the largest size sewer that you mentioned of the intercepting sewer?

Mr. Clausen: The largest is fourteen feet; there have to be two intercepting sewers, one for the north side and one for the south side. With these sewers the sewage and the storm water will have to be conveyed into Chicago River by means of pumping.

The President: What is the area of Chicago that drains at present into the lake, and which you propose to take care of by these intercepting sewers, in acres?

Mr. Clausen: About between thirty and forty square miles. I should say about thirty square miles.

Captain Beach: I would like to ask Mr. Clausen if I understood him to say that their sewers are calculated upon an amount of water, one and one-half inches per hour reaching the sewer? I would like to ask if that has not been insufficient. I have seen statements to that effect in Eastern papers but we all know that we cannot believe everything that we see about Chicago in the papers.

Mr. Clausen: I was surprised to see the amount of rainfall figured on in Washington. I did not say an inch and a half an hour, but three inches and a half in twenty-four hours. It must be borne in mind that Chicago is absolutely flat; if we were lying in a valley or had steep grades, we would have had to use different figures. Owing to the fact that Chicago is so flat we get good results from figuring only three inches in twenty-four hours. If we design a sewer that is going to drain the business part of the city or a district that will build up as a business portion in time, we figure there that three inches in twenty-four hours should be taken care of by sewers, but in resident portions and outlying districts we figure that only one-half of it need to go into the sewer at once and the other half will gradually find its way into the sewer.

The President: I understand you provide three inches' rainfall for twenty-four hours.

Mr. Clausen: Yes.

THE PRESIDENT: That is, at that rate, at the rate of three inches per twenty-four hours.

MR. CLAUSEN: Yes.

THE PRESIDENT: That would bring it down to a small matter of one-eighth of an inch per hour.

MR. CLAUSEN: Yes.

THE PRESIDENT: Is that all the rainfall you have had here?

MR. CLAUSEN: No, we have had exceptional rainfalls that have amounted to two or three inches per hour, but, as a rule, the maximum rainfall for Chicago has been only two and ninety-five one-hundredths (2.95) inches in twenty-four hours, with the exception of a few sudden squalls or showers that have run up to the rate or three inches an hour.

THE PRESIDENT: You mean two inches in twenty-four hours, but that may occur in any hour and a half?

MR. CLAUSEN: We have had cases of that sort.

THE PRESIDENT: What do you do with the storm water in such cases?

MR. CLAUSEN: In those cases on our flooded land this storm water will lie on the surface until the sewer has time to take it off.

MR. PEARSON: We have heard considerable about Chicago sewage and I want to say that I think every gentleman present could come here and spend a week and learn a great deal about sewage. I had the pleasure of living here about two years. In the city of Louisville, although we may not be of very great importance compared to such cities as Chicago, Boston and New York, with these immense buildings that they ought to build wrong side up, so that the foundation will eventually rest in the sky, yet we have about twenty-one square miles of sewerage, that is, we have about twenty-one miles of area, and have sewers that combine the two systems. Our principal sewers (the largest of them) are eleven and one-half feet in diameter. I have had a great deal of trouble in the last few months with one small sewer, eighteen inches in diameter, which principally had house-drainage alone. It has been almost impossible to keep this sewer clean and free of sewer gas. On the contrary, we have very little or no trouble at all in keeping the combined sewerage system clean. On the Fourth of July last we had a rainfall of about five inches in less than an hour, and the result was that our sewers were overcharged and the caps (which weigh about 100 pounds) were lifted out and the water shot up as high as four or five feet. Now such rainfall occurs there sometimes, and though they do much damage, filling cellars and undermining foundations, at the same time they flush the sewers clean. We have a great deal of experience in the combined system and prefer it to any other.

When I asked Mr. Clausen about how he managed to clean his sewers, I, of course, understood it is a very easy matter to run the rods through a partially filled sewer, but how is it with one entirely filled, so the rods will not go through. I have four hundred feet of one-inch gas pipes that I can connect together in four feet sections in such a way that I can run water under pressure through it and project it against the obstruction in the sewer at any point and start the flow. I have not understood exactly how he manages to get through one of the sewers that is completely filled. We propose, where we have the house drainage alone and to prevent the sickening smell of the sewer gas in hot weather, to put in regular flush tanks and flush these sewers anywhere from five minutes to once a day or less. We have one now in operation and since we put it in we have had no trouble at all with the eighteen-inch sewer mentioned. We do not now build any sewers less than eighteen inches in diameter, from the fact that we can get a man through them if necessary. There is no trouble to get rid of the gas with manholes pretty close together and by the help of a big portable flush tank.

Mr. Frost, Plainfield: I represent a small city and therefore feel somewhat out of place among the representatives of so many large cities. But I have just completed 24 miles of an interesting system of sewerage, combining with it disposal of the sewage on land, which latter, I feel certain, is a novelty to most of the delegates present, although probably some of them are more or less conversant with it.

While engaged in business in the City of New York, I live in Plainfield, New Jersey, a beautiful city of 19,000 population, largely composed of New York business men. Four years ago the tax payers decided in favor of building a system of sewers. We are seven miles from the nearest point of the Raritan River, and just below New Brunswick, nine miles distant, is the nearest point at which we can discharge into tide water. Between us and the Raritan is a ridge of shale, through which we would have to tunnel for 9,000 feet at a depth of 30 feet from the surface. Our Corporation Counsel said we could discharge into the Raritan, but he would not assure us against trouble after we got there, as we would probably conflict with various rights, such as riparian, fishery, and possibly others, so that it was not, under the circumstances, deemed prudent to build the nine miles of outfall sewer at the large cost of construction, and hence the adoption of the system of land disposal of the sewage.

Our city is peculiarly located. We are in Union County, wedged in, on one side by Somerset County, and on the other by Middlesex, so that we have to dispose of the sewage inside of our own city and have only a very limited area to choose from. We started out to build the model "Separate" system of sewers and Sewage Disposal on land, of this country, and I think we have succeeded.

Plainfield, as its name indicates, is an almost level plain, so that the sewers are necessarily laid on rather flat grades. Across the easterly side of the city runs a ridge of low hills, which marks the westerly limit of the great ice cap of a former geological age, and the overwash moraine therefrom deposited in this valley, first, small boulders close to the hills; lower down coarse gravel, and then from gravel on down to fine sand, so that we have the ideal material for building sewers in, there being scarcely any leakage into the pipes from the dry surrounding soil. It is unnecessary for me to go into the details of construction.

The disposal of the sewage is the most interesting feature. The city bought 51 acres of sandy land, at the western end of the city, onto which the sewage is delivered by gravity through an outfall pipe of 24 inches' diameter, laid on a grade of one foot in twelve hundred. From test pits samples of sand taken were analyzed by Mr. Allen Hazen, at the Experiment Station of the Massachusetts State Board of Health, at Lawrence, Mass.

About 20 acres were laid out into as many square beds with intervening embankments in which run the distribution pipes; manholes were placed at intersections, with gates to flood four beds from each manhole. Corn was planted on the bare sand, and in cultivating the corn the ground was stirred up, so that the absorbing quality was very much improved and no offensive odors were experienced. An adjoining village, 2,000 feet distant, may be said to have a standing committee watching for a chance to get out an injunction against us, and, consequently, the care of the disposal beds has to be very thorough. The time will come in this country when a sewer farm will not be considered especially offensive. I visited the great sewer farm at Croydon, England, in 1895, and so far as any offense was concerned, I could not realize that I was surrounded by a square mile of sewage covered fields. The only difference between it and the surrounding region was that it was so beautifully green and fertile, and in no part of the country is the health of the inhabitants better than on these sewage farms.

I also visited the sewage farm at Wimbledon, about five miles from Westminster Abbey. The soil was at first so hard that in cultivation it took four horses to pull the plow through. After many years of sewage disposal on that land it has been reduced to what they call "two-horse land." Mr. W. Santo Crimp, a prominent author on sewage disposal, was the engineer of the farm, and he was also a member of the London County Council. The effluent is discharged into the river Wandle, one of the tributary streams from which water is taken for domestic use in one district of London. All sewage flowing into the Thames above Chelsea has to be purified. The time is coming when London itself may be obliged to dispose of its enormous volume of sewage (greater than that of all the large cities of America put together) by land purification. It is, therefore, important that the engineers of this country and municipal officers become acquainted with the method. There is nothing new about it; its efficiency has been amply proved and it is the method which will be adopted by interior cities, where the pollution of streams will not be allowed, or where no large volume of water exists. I was asked this spring at Dayton if sewage could be purified on Ohio clay with success. I did not think it practicable at that time, but since then I have read that in some of the English cities sewage is purified on clay, and, while it takes a longer time for purification, yet it is effective.

Having demonstrated the practicability of disposing of our sewage on a limited area, and without any noticeable offense, the next move is to reduce the cost of maintenance of the system. Some of the English farms have been made to pay, although I believe the general experience is a deficit. However, we are especially well situated, having our own city for a market, and nearby the cities of New York and Philadelphia. There may be objections to the products of these farms, but these will disappear just as it has in other countries. The American is a little more sensitive perhaps than the native of Germany or of France, for a time, but the fact is that the choicest vegetables our numerous tourists to Paris and Berlin consume are from sewer farms of these cities, and once it is understood that there is no danger to health, and nothing in the taste or otherwise, excepting superior excellence, the prejudice will disappear.

Mr. Clausen: I would like to ask what you do with the sewage in the winter time? Do you spread it over the beds?

Mr. Frost: We dispose of the sewage daily in all seasons without regard to temperature. The warm sewage sinks into the ground in the coldest weather we have in New Jersey, although not so rapidly as in warmer weather. The sewage is brought to a collecting tank of two compartments, which are used alternately, and in which the sewage is screened by *upward* filtration; the resulting sludge is held at the bottom, and later discharged onto small sludge beds; the screened sewage flows through carrier pipes to the beds where it is disposed of by *downward* intermittent filtration; no chemical process is used; "time and bacteria" will take care of any class of house sewage.

Mr. Clausen: Some thirteen to fourteen years ago the town of Pullman was built in the southern part of Hyde Park, now a part of Chicago, and this system of sewage disposal was adopted, and the Pullman company intended and did build a model city. It is an exceptionally well-built city, all brick, and there was expended millions of dollars. Nothing but the very best sewage system would do. They adopted a separate system of sewers, then built sewage sewers and storm water sewers and the sewage was conveyed down to the farm about two miles south of Pullman. Quite a lot of money was expended on this farm in turning over the soil and building distributing beds and so on. This farm was in operation for, I should say about three years, and our technical papers at the time were full of the description of the beautiful way of disposing of sewage. Two or three years afterwards I happened to be working in the vicinity of this farm and I noticed a large open ditch about eight feet on top and I should say three feet on the bottom and about two feet deep where a suspicious looking blue matter was floating through this ditch and I was wondering where this matter could come from, because I did not know of any sewers that had such a big outflow at that time and I investigated the matter and I found it came from the Pullman sewage farm. A couple of years ago, possibly three years, they have extended an out-flow sewer—an iron pipe twenty-four inches in diameter—where the sewage is forced by pressure down from the farm, down about another mile or a mile and a half to the Calumet River, and all the sewage goes into the Calumet River and they have abandoned the sewage farm.

Mr. Frost: I wish to say that the cases of Pullman and Plainfield are entirely different. The Pullman sewage farm is at one extreme and the Plainfield farm at the other. The former was run for profit, the purification of sewage being made a secondary matter; when vegetation has received all the sewage it will bear, the raw sewage is simply turned into Lake Calumet; in the case of the latter (Plainfield) the purification of sewage is the paramount consideration, and the most skillful expert advice has been secured to ensure such a result; great care is taken in distributing the sewage, and in keeping beds in first-class condition. After sewage purification is accomplished any possible revenue to be obtained from working the farm is accepted with thanks and credited to maintenance account. The neglect of the sewage disposal feature of the Pullman farm has worked injury to disposal by land methods on account of the prominence given to the entire scheme of Pullman city and its accessories.

Mr. Clausen: I will say that I believe there are cases of small towns so situated that the best way out would be as the gentleman has just said to dispose of the sewage upon sewage farms, and undoubtedly there are localities that are specially adapted for that mode of doing, and I believe that this town of Plainfield must be one, but I think it is a very dangerous idea. I think that the sewering of Pullman at the time caused a great many smaller towns to adopt the same method where such methods should not be adopted, and I think we should be very cautious to adopt the sewage disposal on land unless there is no other way out of it, and the land surrounding them is especially adapted for such purpose, otherwise some other method ought to be, in my opinion, adopted. At any rate, I believe that it will be a source of expense to any municipality or small town. For a larger town I think it is out of the question to adopt it, because I do not think such a sewage farm can be made self-sustaining, if you take the proper care or charge of the sewerage. As far as the town of Pullman is concerned, I admit that the land of the sewer farm is not very high, but it lies some six or seven feet above the river or lake, and it is not a sloughy piece of land where the water stands. It has been used for farming lands for years and it is barely possible that the Pullman company, who still operate their own plant,—it is barely possible that they made this rearrangement and pumped the sewage into the Calumet River for the sake of avoiding the expense of keeping up the sewage farm, that the disposal of the sewage on the farm was an expense to them, and it is barely possible that that is the reason. At any rate, they have abandoned the sewage farm.

Mr. Stainsby: This is an important question, especially to smaller towns, and we might take the whole morning, it seems to me, in discussing this problem. I think that at our next meeting the gentleman who introduced this subject from Plainfield should prepare a paper with reference to sewage and the experience he has had. He has been abroad also. We could then next year take it up with profit. I think, notwithstanding this experience at Pullman, that it is a good plan. At Morris Plains Insane Asylum, in New Jersey, they are doing the same thing as the gentleman from Plainfield suggested, and I believe, notwithstanding the gentleman from Pullman says that it will not be self-sustaining, I wish somebody would introduce a sewage system that is even part sustaining. With us it is all outgo and no income. If we can only dispose of it advantageously and get some return for our money it would be far in advance of anything we have had, and I would make that suggestion and request that the gentleman who is well adapted, give us a paper at the next meeting, and give us the benefit of his experience.

The President: I have no doubt that Mr. Frost will be very glad to favor the Society with a paper on this subject at the next convention. He has consented to prepare such a paper and I know it will be one of the most interesting papers on that subject next year. Time is advancing and we have to close the order of business we are now under.

The next is the report of the Committee on Water Works and Water Supply by Mr. H. Van Duyne, Newark, New Jersey. Chairman.

Alderman Saunders of Toronto here asked permission to introduce the following resolution:

"Whereas, it is now the custom for municipalities to apply to one another for information in regard to works, practice, etc.

"Be It Resolved, That as the 'American Society of Municipal Improvements' has now become an established association, all such applications for information from others than members shall be referred to the Association for their action thereon, it not being desirable to impart information to those who are not in affiliation with the Association."

ALDERMAN SAUNDERS: The object I have, Mr. President, in introducing this resolution is twofold; one, to bind us closer together and the other to induce municipalities who are not now members, to become so. The method of carrying it would be very simple. They apply to us for information and I think you and many others here know that we are being continually applied to. We would send a circular and ask them to become members (provided they are not so at present), and if they are members we would send the information required to them at once. In sending the municipalities a copy of the index the Association Secretary can send a circular to them embodying this resolution, and I think in that way we should be able to attain our object.

ALDERMAN LESLIE, Toronto: I take much pleasure in seconding the resolution. This is my first attendance at the convention. I notice that Toronto is the only Canadian town represented here. I think that was the case last year, and it is evident that Toronto recognizes this Association as one that may do a great deal of good in bringing out information on these different questions. I must say that from attendance here I have been surprised at the mass of information which can be brought out by discussion on these different topics. I think that the information which is imparted in this way should be the property of the Association and outsiders wishing this information should not get it without becoming members of the Association. It appears to me that this Association is one that, properly conducted and carried on, will exercise a wonderful influence in improving municipal government and I think, that being the case, that it behooves every municipality to become members of this Association, thereby drawing us together and bringing out information. I second the resolution and I think the intention is to submit it to the Executive Committee.

MR. SAUNDERS: I think it ought to be referred to the Executive Committee.

THE PRESIDENT: The resolution will be received and referred to the Executive Committee with the request to report before the close of this Convention.

The following report was then read by Mr. Van Duyne:

REPORT OF COMMITTEE ON WATER WORKS AND WATER SUPPLY.

TO THE THIRD ANNUAL CONVENTION OF THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

Your Committee on Water Works and Water Supply, in endeavoring to formulate a report, has found the field so wide and the practice depending to such a large extent upon local conditions, that they have decided to embrace in their report only a few of the subjects in connection with this question which are of the most general application; these subjects, although not new, having been brought prominently to notice by the experience of the past year or two.

We have not attempted a thorough analysis of the difficulties, but desire to bring these questions to the notice of the Convention in order that they may be freely and fully discussed.

During the past year perhaps the most general and serious cause of complaint in connection with water supplies has been due either to impurities from sewerage contamination in lake or river supplies or to the objectionable odor, color and taste which are sometimes detected in supplies drawn from storage reservoirs, especially during the summer months.

Your Committee has endeavored to obtain papers for the Convention upon those features of the water supply question, and some, we understand, will be read at this meeting. It may, however, be advisable to refer to the subject briefly. It seems to be universally conceded that the objectionable conditions found in connection with stored water supplies arise from the growth of algae or other organisms in the water, which organisms sometimes decompose after the water has entered the distribution system. While it has practically been demonstrated that this growth and the condition of affairs resulting herefrom are not necessarily injurious to health, yet they produce very objectionable and undesirable results which should as far as possible be prevented. Not only does the growth of algae in the reservoir affect the quality of the water supply at the time, but its effects are apt to be of a more permanent nature by growing within and fouling the pipes, thus considerably reducing their carrying capacity, besides making the water turbid or roily in its passage through the distribution system. So far as your Committee has been able to look into this question, one of the most effectual means of prevention of trouble from this source in most cases is the removal of shallow places in storage reservoirs and the exclusion of sunlight from distributing reservoirs where such growths are liable to form, while in some cases a thorough aeration of the water from the reservoir before the same is delivered into the distribution system will be found extremely beneficial. These methods, however, are not always practicable owing to the want of funds or for other reasons, nor can they in every case be depended upon as effectual remedies, as the normal condition of the water and local circumstances require in every instance careful, scientific and intelligent study. The aeration of water supplies subject to these growths has, however, produced such satisfactory results, that in designing or remodeling work, liable to be affected by them the engineer should always, in the opinion of your Committee, carefully consider the advisability of embracing this feature in his designs.

Another difficulty which seems to have caused more trouble than usual during the past winter in connection with the management of water works, especially in our northern cities, was the formation of anchor ice on screens at the reservoirs and intakes, which in a number of instances caused an entire stoppage of the flow and a complete shutting off of the supply sometimes for days at a time. This situation is so serious and happens so suddenly and often without warning, that adequate measures should be taken to prevent such a condition of the water from interfering with the maintenance of a supply. In designing works it would seem not only advisable but absolutely necessary to take this factor into consideration. A remedy can sometimes be applied by placing the gate-house on the most protected side of the reservoir, if indeed it would not be well to provide duplicate gate-houses. This would also lead to the suggestion of considering the advisability of arranging the principal discharge and distribution mains, as far as practicable, in a dual manner to provide against sudden interruptions and emergencies.

It will often be found convenient to arrange feeders in pairs, that one can be cut out temporarily without materially affecting the supply.

The subject of pollution, while the most important phase of the water supply question, is one which must of necessity be taken up by each community for itself. Your Committee, while holding their own opinions on the subject, are not at present prepared to define a standard of purity for water for domestic purposes. There are, however, certain positively harmful impurities the allowable limit in the quantity of which might with advantage be more generally agreed upon. Feeling that this is of vital importance to the public water supply question, we would respectfully recommend the collection by this Society of data and analyses both chemical and biological (but particularly the latter) which can be made the basis of a thorough report on this important question.

The continuous and eventually dangerous action of electrolysis upon the underground piping of a city, and the fact that no entirely satisfactory means of preventing his action from taking place to some extent, would also suggest that this subject be made one for special investigation and report by the Society.

Among the results of the year of interest in connection with the water supply question, is the more definite determination of the carrying capacity of riveted steel pipe lines. We are glad to be able to report that what has hitherto been a disputed problem between some hydraulic engineers of the highest standing in their profession on this continent, has been apparently satisfactorily determined and solved by the recent measurements of the flow through the 26 miles of the Newark conduits.

We beg the indulgence of the Convention for presenting so brief a report on such an important subject as "Water Works and Water Supplies," but as most of the questions in connection with the subject have been so fully discussed in printed reports and works, we have only deemed it necessary at present to refer to some of the most vital points requiring the attention of water works managers, in the hope of bringing out a beneficial discussion.

Respectfully submitted,
HARRISON VAN DUYNE,
E. H. KEATING,
Committee Water Works and Water Supply.

The paper prepared by Mr. J. W. Hill, Consulting Engineer, Cincinnati, Ohio, was, in Mr. Hill's absence, read by Dr. Prendergast, as follows:

THE WATER SUPPLIES OF EIGHT CITIES IN RELATION TO TYPHOID FEVER RATES.

BY JOHN W. HILL, C. E., CINCINNATI, O.

GENTLEMEN:

I propose to occupy your time for a few minutes to-day in the relation of some facts connected with the public water supplies of four well-known cities of Europe and four well-known cities in this country, the purpose of which is to show you that, in the matter of hygiene of our public water supplies, we are far behind our neighbors of Europe, and that, in the face of convincing evidence of the value of water of high quality, we still continue to supply our people with water unfit for drinking and other dietetic purposes.

The first city to which I shall direct your attention is Berlin. This city is now supplied with water from two stations, one at Charlottenburg, taking water from Lake Tegel, and the other and newer station at Frederickshagen, taking water from Lake Muggel. Referring to Lake Muggel, the water from this source is, in its natural condition, superior to that of many of our principal cities, and, judged by the standards of quality which have prevailed and still prevail in this country, would be considered in many cities as quite good enough for any or all the uses to which our public waters are applied, including drinking. That is to say, in many situations, this Muggel water would be pumped from the lake to the reservoirs or to the consumers, without any attempt at improvement in its quality.

Not so, however, with our friends of Berlin. Something better than this raw water of Lake Muggel is required by their standard of hygiene, and, to obtain it, this already fairly excellent water is passed through an elaborate system of filters, devised by the late Mr. Henry Gill, the engineer, during his lifetime, of the Company which controlled the supply of water to Berlin.

The cost of filtering water is an additional charge to the cost of pumping and distributing it to the consumers, and in Berlin amounts to $10.00 per 1,000,000 U. S. gallons. This includes, I am informed, the interest and sinking fund charges on the filter works.

It is sometimes said that people do not do certain things altogether "for their health," but I can assure you that the costly filtration of the water from Lakes Muggel and Tegel is solely for the health of the citizens of Berlin. The average typhoid fever death rate of Berlin for the past six years was 7½ per 100,000 of population living, while for the same time the average annual rate for 28 of the principal cities of this country and one in Canada (Toronto) was 50, or our average rate was nearly seven times that of Berlin.

To state the same fact in a different form, the chances of taking and dying from typhoid fever during the past six years were seven times as great in the larger cities of this country as in Berlin.

In regard to the claim sometimes made that water is not generally used as a beverage in the cities of Germany, I have been at some pains to obtain information upon this point, and the answer is that while the use of beer and wine is more general in Germany than in this country, at the same time, with possibly few exceptions, water is a part of the daily diet of the Germans, and, recognizing the dangers to health lurking in sewage polluted waters, they are very careful to drink only such water as complies with the German Imperial Standard of Hygiene.

The next city upon my list is Zurich, Switzerland, and some of the conditions surrounding the water supply of this city are not unlike the conditions found about Chicago.

Zurich takes its public water supply from Lake Zurich, a mountain source high above the usual channels and sources of sewage pollution, and one which a few years since would have been accepted as being above suspicion. Investigation, however, reveals the interesting fact that even in this body of apparently pure mountain water much organic matter and large numbers of bacteria at times have been found. Some sewage and polluted surface drainage must necessarily find their way into the lake from the cities and towns on its horders, but the area and great depth of the lake was at one time regarded as sufficient to prevent serious contamination of the water by these means. The lake has a surface area of nearly 50 square miles, and an average depth of 230 feet, and, being hemmed in by high mountains, any disturbance by heavy gales, such as might stir up the water to great depths, is unknown.

Disastrous epidemics of typhoid fever have taught the people of Zurich that the water of the lake is not to be relied upon for drinking and dietetic purposes at all times, and now all water from the lake is carefully filtered before it passes to the consumers.

The next city on the list is The Hague. Here the water is first obtained from driven wells sunk in the sand dunes, and afterwards passed through filters of moderately fine sand. The driven well water from the sand dunes is probably comparable with much of the driven well water which, in this country, we are accustomed to accept for public supply, but the old-fashioned burghers of The Hague seem to think that better water than this is required for drinking and some other uses, and go to considerable expense to secure it by slow filtration through beds of fine sand.

It is interesting to note that of all the larger cities in the world, The Hague has had for the past six years, with the exception of 1891, the lowest typhoid fever death rate. The average typhoid fever death rate for The Hague, per 100,000 of population living, inncluding 1891, for six years past, was lower than five, and excluding the rate for 1891, the average for the other five years was 3.8, or slightly more than half the rate previously mentioned for Berlin.

Comparing this rate with the average rate for the large cities of this country for the same period of time, it appears that our death rate from typhoid fever was from ten to thirteen times that of The Hague.

At this point I wish to ask the members of the Convention if they do not believe that our typhoid fever rates should be as low as those of the cities of Europe. Do you not think that the same methods which are known to have reduced the typhoid rates of the cities of Europe, if applied here, will have the same effect? Do you agree with me that the time has arrived to stop supplying our helpless citizens with water which is carrying the germs of disease into many families, and that it is our duty to see that the present conditions shall exist only for such length of time as may be necessary to apply the proper remedies?

The last city in Europe to which I wish to refer is Liverpool. This city now obtains its water from a large artificial lake in the valley of the Vyrnwy River, in North Wales, distant about 65 miles from the city. The watershed from which Lake Vyrnwy is supplied is in the wildest part of the country, the nearest railway station, as I am informed by my friend, Mr. Rafter (who has visited the works), is twelve miles distant, and, altogether, the catchment area is one that would recommend it as being free from obvious sewage pollution.

The water impounded in Lake Vyrnwy should equal the impounded water of many of our large cities, but every gallon of water from the lake is first filtered before it flows into the mains of Liverpool.

With the exception of mountain springs, such as supply Vienna and Munich, or carefully planned works for ground water, such as supply Dresden, or deep well water, such as supplies the Kent district of London, the foreign engineers generally seem to regard all other of the usual sources of water supply as open to suspicion.

The City of New York, as is well known, obtains its public water supply from a number of large impounding reservoirs (including Croton Lake), constructed in the valley of the Croton and Bronx Rivers. The watershed from which the runoff of rainfall is gathered in these reservoirs, is not free from human habitations, and, in spite of all precautions taken by the city, some sewage polllution of the Croton water is liable to occur. The water of New York ranks high in quality when compared with the public supplies of many other American cities, but it fails to attain the high standard of excellence reached by several cities abroad.

Excepting mountain spring and deep wells in the rock and drift, it is probable that the Croton water is equal in quality to that from any natural sources, but it is still inferior to the filtered water of London, taken from the River Thames, to the filtered water of Berlin, from Lakes Tegel and Muggel, to the filtered water of Hamburg, from the River Elbe, and to the filtered water of Rotterdam from the River Maas.

The typhoid fever death rates per 100,000 of population living for New York, London, Berlin, Hamburg and Rotterdam are given in the following table:

	1890.	1891.	1892.	1893.	1894.	1895.	Average.
New York	21	22	22	20	17	17	20
London	16	15	11	16	15	14	14-½
Berlin	9	10	8	9	4	5	7-½
Hamburg	28	23	34 (28)	(18)	6	9	7-½
Rotterdam	6	4	6	5	4.8	2	4-6-10

The filters at Hamburg were started in service during the year 1893, for which year a part of the supply came direct from the River Elbe to the consumers, and during the latter portion of the year the water was filtered before it went to the consumers.

Now, mark the effect of filtration of the sewage polluted Elbe water, under the able supervision of my friend, Dr. Dunbar. For the three years prior to filtration of the Elbe water, the average number of deaths from typhoid fever per 100,000 of population for each year were 28, and, when the water supply was filtered for the years 1894 and 1895, the average deaths from typhoid fever were 7½ per 100,000 of population, or the reduction in the typhoid rates amounts to nearly 73 per cent. Is not this a record of which any city may be proud?

Recent information from Hamburg leads me to expect a lower typhoid fever death rate for this year (1896) than the city had for 1894.

The City of Chicago takes its water supply from Lake Michigan, into which, according to President Eckhart, of the Drainage Commission, is now being discharged the sewage from 1,567,500 people, and, in addition to the sewage of the city proper, the lake is continually receiving large quantities of refuse and filth from the water craft entering and leaving the port. With favoring winds, it is claimed that sewage from the eastern shore sometimes crosses the Lake to the intake cribs of the city waterworks. No attempt is made at purification of the water before it is supplied to the consumers.

In a lecture which I had the honor to deliver before the faculty and students of the University of Illinois last winter, I made the following statement, with reference to the public water supply of Chicago:

"The cities of Berlin and Chicago are nearly alike in population, but they are very unlike in their typhoid fever rates, as is shown by the following table for the past five years:

	1890.	1891.	1892.	1893.	1894.	Average.
Berlin	9	10	8	9	4	8
Chicago	83	160	104	42	31	84

"That is, the average death rates from typhoid in Chicago for the five years mentioned was nearly 10½ times that of Berlin."

"The drainage areas from which the City of Berlin obtains its water supply are protected from sewage pollution, and the water from Lakes Tegel and Muggel is very carefully filtered until it complies with the requirements of the Imperial Board of Health, before it is delivered to the consumers. Until Chicago devises works which will render its public water equal in quality to that of Berlin, it can not hope to have the low typhoid fever rates which prevail in the German capital."

"Apart from the difference in the quality of the waters, there seems to be no reason why the City of Chicago should have a higher typhoid fever rate than Berlin. Both are business and social centers, with large floating populations, and more exposed than smaller or less populous cities to the influence of imported infection, yet, in spite of this, Berlin, by reason of the care exercised in maintaining the quality of her public water supply, has nearly the lowest typhoid rate of any of the capitals of Europe."

From information furnished me by the Commissioner of Health (Mr. Wm. R. Kerr), the water supply of the city previous to January 1st, 1893, was taken from the two mile intake cribs, and from points in the lake less than two miles from shore. The average typhoid fever death rate for the years 1890-91-92 was 116 per 100,000 of population, while for the three years, 1893-95 inclusive, the rate was 35 per 100,000 of population, the lower rate being ascribed to the extension of the tunnel intakes to the four-mile crib. The typhoid fever death rate for 1895 was 32 per 100,000 of population and from recent reports received from the Health Department of this city, the rate will be quite 60% higher for the present year than for 1895, or will approach 51 deaths per 100,000 of population.

The city is about to take steps in the direction of an improved quality of public water, and the best evidence of necessity for this can be had from the typhoid statistics for the past few years.

The rates prior to the opening of the four-mile tunnel were awful to contemplate, and the rates since the opening of the four-mile tunnel are altogether too high for a city of the population, wealth and enterprise of Chicago.

The last cities to which I wish to draw your attention are Philadelphia and Cincinnati. The conditions surrounding the sources of water supply for these cities are quite the same. Each city takes its water from a river which is the channel of sewage discharge above the point of intake, and, as one might naturally suppose, from knowledge of the facts, the typhoid fever death rates of these cities are not only high when compared with cities which are enjoying superior water supplies, but are nearly alike. The death rate pr 100,000 of population for the six years ending December 31st, 1895, for Cincinnati, was 49.7 and for Philadelphia, 46.8.

In neither Philadelphia nor Cincinnati is any attempt made to improve the quality of the water before it is delivered to the consumers, but the plans proposed by the Engineer Commission for the latter city contemplate the pumping of the water from the Ohio River to large subsiding reservoirs, from which, after a reasonable time has been allowed for pecipitation of the heavier suspended matter, the water will be drawn to filters which were designed upon the same general lines as the filters of Hamburg.

The officials and citizens of Philadelphia seem to fully realize the necessity of radical measures for improvement in qaulity of their public water, but no decisive steps have been taken there to reach this end.

In my lecture previously mentioned at the State University, I took occasion to show the money value of the annual typhoid fever loss, which for the whole country was estimated at $527,750,000, an amount (capitalized at 4% for fifty year) which represents over eleven times our National Debt.

It will be interesting at this time to estimate, from a financial standpoint, the losses to Chicago from typhoid fever since 1890, not including the present year.

The total number of deaths from typhoid fever for the six years ending December 31st, 1895, were 6,174, and the cases that recovered. estimated at five times the deaths, 30,870. The value of a human life, under the laws of Illinois, I believe, is $5,000.

The value of lives lost will be	$30,870,000
Burial expenses	370,440
Medical attendance, all cases	1,481,760
Loss of time by those who recovered, estimated at $1.50 per day for 6 weeks	1,666,980
Total	$34,389,180

representing an average annual loss of $5,731,530, a sum which, if capitalized at 4% for fifty years, will represent an investment of $123,125,186.00.

This is upon the assumption that all cases of typhoid fever are preventable. While I believe this is possible, the prophylactic measures necessary to remove typhoid fever from the list of diseases altogether, seem to be too costly for the present generation.

It will be more reasonable to assume the possibility of reducing, by practical methods, the death rate from typhoid in Chicago to 10 per 100,000 of population, and this, based on the estimated death rate for the present year, will represent a saving of at least 40 lives per 100,000 of population. Taking the population in round numbers at 1,600,000 this will represent a saving of

640 Lives valued,	at	$5,000 each,	$3,200,000
640 Burial expenses,	at	60 each,	38,400
3,840 Medical expenses,	at	40 each,	153,600
3,200 Losses of time,	at	54 each,	172,800
Total,			$3,564,800

a sum, which, if capitalized at 4% for fifty years, represents an investment of $76,579,319.

You will observe that the rate of 10 per 100,000 of population for the annual mortality from typhoid fever, is considerably in excess of the average annual losses for the past six years for the cities of Berlin, Rotterdam and The Hague, and ⅛ greater than the typhoid mortality rate for Hamburg since the Elbe water has been filtered.

In connection with sources of water supply, like our Great Lakes, and large impounding reservoirs, such as constitute the sources of supply for New York, Boston, San Francisco and other cities, it is well to remark that seasonal changes in temperature in the several strata of water, combined with winds, produce considerable variation in the quality of water at different seasons of the year for the same depth, and it is not possible, as some suppose, to select a depth of intake in such lakes which will, at all times, furnish the best water from such sources.

Under certain conditions of air temperature, the best water may be found near the bottom of the lake and under different conditions of temperature the best water may be found near the surface. This subject is very ably presented and discussed in a paper by Mr. Desmond Fitzgerald in Transactions of the American Society of Civil Engineers for August, 1895.

The substance of Mr. Fitzgerald's paper is that twice each year there is a more or less complete rotation of the body of water in large lakes and impounding reservoirs, the cooler water at the surface passing downwards to the bottom, or while the warmer layers of water at the bottom or at considerable depths from the surface pass upwards to or near the top.

These overturnings and readjustments of the layers of water, according to temperature, will be accelerated and augmented if taking place during seasons of high winds, which frequently is the case.

With this rotation of the water strata occur marked changes in the quality of the water at different depths of the lake, causing organic matter which has lain stagnant for months on the bottom of the lake or reservoir to be brought to the surface to undergo, in due time, precipitation again to the bottom.

Under this condition, which the investigations of M. De Saussure and others abroad have shown, and which Mr. Fitzgerald and others in the Eastern States have amply confirmed, it is apparent that the best water in lakes of more than 25 feet in depth cannot, throughout the year, be obtained from any fixed depth, and that the depth at which the water should be taken should vary with the seasons, to avoid, as well as possible, the influence of these seasonal overturnings and disturbances of the layers of water from the surface of the lake downwards.

It has been customary heretofore to fix the depth of intake near the bottom of such lakes and where the water is pumped from the lake to filters, as at Zurich, Switzerland, it is immaterial where this depth is taken, provided the intake is not so near the top as to take in water subject to the direct influence of the sun's rays in summer, nor so near the bottom as to stir up the precipitated organic matter by the currents of inflow to the pumps, but in cases where filtration is absent, the depth should be variable and adapted to take the best water surrounding the point of intake.

In conclusion, I wish to call attention to an error which often finds its way into papers and discussions on the cause of typhoid fever. Many writers, including some learned physicians, are prone to the theory that typhoid fever can be traced to sewer gases, holding them as causes, when they are not and cannot, in the light of present knowledge, be considered as causes.

Sewer gases and atmosphere containing the gases from putrefying organic matter are deficient in oxygen and may be regarded as having a strong influence on the susceptibility of persons to typhoid fever, but are entirely distinct from and independent of the cause of this disease.

Thus with a perfect system of sewerage, drainage and ventilation, but with a sewage polluted water supply, typhoid fever will still exist, although with rates reduced in some proportion to the improvement of the quality of atmosphere inspired.

But with a perfect water supply and bad drainage, sewerage and ventilation, while the vitality of persons exposed will be lowered, there will be no danger from typhoid infection, since the cause of typhoid cannot exist in a pure water.

In this case I do not consider the possibility of infection by other articles of diet than water, because it has been shown in the reports of the Massachusetts State Board of Health that quite 99% of all typhoid is traceable to polluted or typhoid-tainted water supplies (Sedgwick).

Therefore, typhoid infection from other causes or carriers than water may be regarded as in the nature of accidents to which we are all exposed, and from which few suffer.

Mr. J. L. Kennedy, member Board of Public Works, Nashville, Tenn., then read the following paper:

WATER SUPPLY.

BY JOHN L. KENNEDY, BOARD OF PUBLIC WORKS, NASHVILLE, TENN.

TO THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT, IN SESSION AT CHICAGO, OCTOBER, 1896.

Water is as essential to the well-being of a city as blood is to the physical man. To secure an adequate supply of pure water is of the first importance to a community, and the method of obtaining and distributing it is a matter that addresses itself to the careful attention of municipal government. The manner of obtaining water is, of course, varied, but the pumping station and reservoir are common to inland cities. The plan for distributing water and supplying it to consumers is, in many respects, the same in all cities and the experience of one may be interesting and beneficial to others.

Nashville, Tenn., a city covering an area of more than nine square miles, with a population of nearly one hundred thousand, is supplied with water of an excellent quality from the Cumberland River. The pumping station is located above the city and the plant consists of one Holly and two Worthington compound condensing engines of the vertical type measuring from base of pumps to top of cylinder about 90 feet and weighing about 420 tons each. They are capable of delivering ten millions gallons of water each in twenty-four hours against a head of 320 feet. These pumping engines gave a duty of 117,000,000 foot pounds based on an evaporation of ten pounds of water. The water is forced through a 36-inch main, 20,750 feet in length, to ar eservoir located within the corporate limits. This reservoir has a capacity of 51,000,000 gallons and the bottom of the basin is 277 feet above low-water mark. The height of water, when the reservoir is full, is 308 feet above low-water mark and is above the highest points in the city. At the pumping station there is a barren island of sand and gravel of great depth and about five acres in extent. Through this deposit have been cut many lateral channels converging to one common point. These channels are walled up with loose stone and are covered over with flagging. They are about 4 feet by 6 feet in their interior dimensions and aggregating more than 2,000 feet in length. They are covered with sand and gravel to a depth of from six to twelve feet and serve an excellent purpose as filters—the water percolating through the sand and gravel. In winter, when the river is a raging stream and the island is submerged beneath a flood of muddy water, these filters yield a large supply of clear, pure water which is pumped therefrom direct into the reservoir. These filtering channels are not perfect in construction, nor are they sufficient in extent to filter all the water taken to the reservoir the year round; but we feel assured from experience, that the method of filtration is valuable and should be adopted wherever practicable. When the filtered water fails, we pump direct from the river to the reservoir.

About three years ago, our State Board of Health determined to have made a most careful chemical, as well as biological, analysis of the water used by the city. They had gathered with great care samples, six in all, and sent them to the Museum of Hygiene in the Bureau of Medicine and Surgery, Navy Department, Washington, D. C. The water test was as follows:

1. Sample of water from the Cumberland River about twelve feet from the "crib" on the upper side about two feet above the bottom and ten feet below the surface of the river.
2. Sample of water from the Cumberland River about twelve feet from the "crib" on the upper side, about two inches below the surface of the river.
3. Sample of water from the Reservoir, western basin, northern angle, near the ladder, about five feet from the bottom and about fifteen feet from the surface of the water.
4. Sample of water from the Reservoir, western basin, northern angle, near the ladder, about two inhces below the surface of the water.
5. Sample of water taken from Hydrant at 629½ Church Street, third floor.
6. Sample of water from Kitchen, 143 N. Vine Street, lower floor.

After an analysis, a report which is signed by A. C. Gorgos, Medical Director of the U. S. Navy, in charge, says: "The analyses of these samples of water reveal a good potable water. They show markedly the improvement of sedimentation, the surface giving less residue than near the bottom, which is what should be expected. They also show a lessening in the ammonia due to self-purification through agitation and sedimentation."

The bacteriological report says: "A number of liquifying bacteria, but none of these pathogenetic (disease producing)."

Nashville being thus supplied with water, the next matter for consideration is the mode of distribution. The water is conveyed from the reservoir to the city through 7,500 feet of 36-inch main, and is distributed by sixty-five miles of cast-iron pipes varying from 24 to 3 inches in diameter.

The daily consumption is about 11,000,000 U. S. gallons. There were on January 1st, 1896, 1,925 metered and 6,215 unmetered services.

The collection for water privileges during the year 1895 amounted to $113,078.74. Of this sum $62,151.76 was received from metered services. In addition to water which yields a revenue, the city supplied without charge, during the year 1895, water to fourteen public schools, sixty indigent families, eleven fire-engine houses, five hundred and eight fire-hydrants, the City Hospital, the Police Station, Work House, and stables, the City Hall, Market House and Cemetery, the stables of the Street and Scanvenger Departments and the Sprinkling Department, public stock-watering fountains and nearly a hundred million gallons for sprinkling about sixty-five miles of streets.

From the experience of Nashville, I am justified in saying that all well-governed cities should own and control their water supply, and that water should be sold by meter measurement.

A paper by Mr. A. S. Tuttle, Assistant Engineer Bureau of Water, Brooklyn, N. Y., was read by Mr. A. P. Lewis, as follows:

INVESTIGATION OF QUALITY OF WATER FOR PUBLIC USE.

A. S. TUTTLE, ASSISTANT ENGINEER, BUREAU OF WATER, BROOKLYN, N. Y.

While many years have now elapsed since attention was first directed to the public water supplies of our cities, as important factors in the transmission of disease, the acceptance of such theory as an established fact, although repeatedly demonstrated with more or less conclusive evidence, has only become general within a comparatively short period of time.

Since the introduction by Dr. Koch in 1881 of his method of making cultures for the study of the bacteria, a marvelous advance has been witnessed in this branch of sanitary science, although there is yet a wide and attractive field for further invstigation. It cannot be disputed, however, that the record of case after case of typhoid and cholera following the use of a polluted water supply, while leaving no doubt among scientists as to their origin, have not yet been sufficiently impressive in several of our American cities to have secured effectual preventive or remedial action. The attendant doubt and uncertainty with which the layman receives statements of facts not capable of proof by direct evidence; the expense connected with the purification of unsuitable supplies, and construction of new works; the trust in old methods and suspicion concerning new; the reckless disregard of the laws of nature; all conspire to retain the use of the notoriously impure and polluted supplies.

The dangers contingent upon the use of impure water are only made intelligent by a proper understanding of the germ theory, which, as enumciated by Messrs. Rafter and Baker in their volume on Sewage Disposal in the United States, "assumes that the active causes of communicable or contagious diseases are minute, living organisms, for the most part capable of independent life both within and without the animal body. . . . . Many forms of bacteria are harmless and must be looked upon as the beneficent friends of man, doing him many a good turn which otherwise he would find it difficult to accomplish. Others are the morbidific causes, when they gain access to the human economy, of the various infectious or communicable diseases . . . The bacteria, although microscopic in size, are still, as far as the evidence goes, divided into distinct species, and by consequence each contagious disease has its own specific germ, which must be present in every case before that particular disease can be developed. Once introduced into the animal body, however, the specific germ, after a period of incubation, finally grows and multiplies enormously; so that while a single germ, or the least atom of infectious material, serves to inoculate a disease in a susceptible person, the contagious matter produced in the course of the disease may be sufficient to inoculate many thousands. In each special disease, the contagion multiplies chiefly in the particular tissues which are especially subject to its action, and the infective germs are cast off from the body with the secretion of those tissues. Thus, in typhoid fever, the seat of the disease is such that the infectious matter passes away in large quantities in the dejections from the bowels."

For determination of the quality of the supply reliance must be placed on an inspection of the water shed, and on systematic chemical and biological analyses. The inspection reveals the nature of the drainage area, enabling the analyst to properly interpret the results which he obtains. It has now become customary for the chemist to insist upon having at least some familiarity with the drainage area prior to passing upon the quality of the water. A populated water shed must always be regarded with more or less suspicion, dependent upon the facility with which drainage from the inhabited sections finds its way into the stream; in some of these cases the possible pollution is avoided by a natural filtration; in others artificial drainage is relied upon; but at all such points the water shed should be thoroughly and frequently patrolled, and offenders of the public health promtply punished.

The geological formation may be such as to diminish the impurities, or it may favor the retention of either the animal or mineral matter; supplies from peaty countries are liable to produce diarrhoea, and are frequently alleged to cause malaria. Conditions are often discovered by an inspection which are in themselves sufficient cause for the condemnation of the supply, and all cases of possible sewage pollution should be thoroughly investigated by the aid of chemical and biological analyses of samples taken at various places above and blow the points of suspicion. The chemist in his report usually states the color, odor, sediment, and turbidity of the water, and the contained parts per 100,000, by weight, of organic matter, mineral matter, free ammonia, albuminoid ammonia, chlorine, nitrates, nitrites, and hardness expressed in equivalent carbonate of lime. While the interpretation of the meaning of these properties and components as found in water from various localities is in large degree a matter of scientific skill, it may be interesting to note some of the general deductions which may be made from such a report. The color of a water is usually rated after removing its turbidity by filtration, by comparison with some established standard adopted as unity of color; several such standards are in successful use, for one of which the unit is produced by treating a known amount of ammonium chloride with a reagent known as Nessler's sollution; prolonged color determinations have been found to be exceedingly valuable in detecting variations in the quality. The odor is determined by violent shaking after heating. The visible suspended matter in a sample after it has stood for twelve hours is known as its turbidity, while the solids which have settled are called the sediment. A turbid water is apt to entangle many impurities, and should be subjected to sedimentation before use; those accustomed to its use do not seem to be affected, while others may not be so fortunate. Sedimentation in a reservoir as often applied, not only removes the turbidity, but also diminishes the number of bacteria, they being entangled and carried to the bottom; it also gives an opportunity for the destruction of the pathogenic germs by those not of dangerous character. Both animal and vegetable matter contain nitrogen which appears as albuminoid ammonia until such time when decomposition sets in, when it is reduced to some salt of ammonia and reported as free ammonia; the further process of purification reduces the free ammonia to nitrites or nitrates, the latter being the final step in the conversion of organic into mineral matter; animal matter is richer than vegetable in nitrogenous compounds, and the possibilities of incomplete decomposition makes it evident that their presence in large quantities is not desirable unless shown to be caused by unobjectionable vegetable material: both free ammonia and nitrates are usually present in the atmosphere and are, therefore, found in rain water, causing analyses made after storms to show higher proportions than during seasons of drought; free ammonia is usually higher in winter, and is often found in waters obtained from great depths where its presence may often be due to the decomposition of salts of ammonia natural in the strata. Chlorine usually occurs as sodium chloride or common salt, which finds its way into the supply from saline deposits, proximity to the ocean, or sewage pollution: that portion which may be attributed to natural formation or location has been designated as "normal chlorine," which being established for a locality leaves the balance charged against contamination. Nitrates, free ammonia, and chlorine, and found in a drinking water, are not in themselves injurious to health, and are only objectionable in that when their presence is not otherwise explained, they must be assumed to represent the amount of pollution to which the supply has been subjected. The hardness of a water is designated as "temporary" or "permanent"; the former is caused by the carbonates of lime and magnesia, which are decomposed by boiling; the latter is due to calcium sulphate and other soluble combinations of calcium and magnesium. If the hardness remains constant it does not appear to affect the mortality, although it may create bowel trouble in those not accustomed to its use. The total solids present include the mineral and organic matter both in suspension and solution: an excessive amount of the former produces a mineral water, while large quantities of organic matter should awaken a grave suspicion concerning the purity of the supply. The sewage of our American cities has been estimated to contain 100 parts each of mineral and organic matter per 100,000. Chemists engaged in the study of the supplies of various localities have endeavored to prescribe a limit beyond which the presence of any given impurity should prohibit the use of the water for domestic purposes; some of these so-called standards, in parts per 100,000, are as follows:

Authority.	Total Solids.	Ammonia.		Chlorine.	Nitrogen as		Hardness as calcium carbonate.
		Free.	Albuminoid.		Nitrites.	Nitrates.	
Rivers Pollution Commissioners of							
Rain Water	2.95			0.822		.003	0.3
Well Water	43.28			5.11		.495	25.0
Prof. Leeds for American Rivers	15 to 20	.001 to .12	.010 to .028	0.3 to 1.0	.0003	0.111 to 0.389	5 to 15
Dr. Vaughn for Michigan	50	.005	.015	1.21	0	.09	
Dr. P. T. Austin for Jersey City	17	.005	.015	0.85	0	0.2	
Haines Standard for Philadelphia	12.57	.0031	.0044	1.19		0.5075	

These opinions, it will be noticed, are at considerable variance, having in most cases been established under local conditions, and are useful only in a general way. Difference in methods often lead to great discrepancies between the quantitative results of analyses of the same sample, when made by more than one chemist, and there is little doubt but that uniformity in these particulars would make the chemical comparison of the waters of various cities much more satisfactory.

Since the first attempt made in 1773 to classify and define the minute organisms contained in all natural waters great advances have been made, but it is only within the last few years that the labors of Koch and Pasteur have made possible a careful study of the disease, producing bacteria, while still more recently the objectionable colors and odors experienced in water supplies have led to increased refinement of observation of the balance of the plant and animal life.

The method of classification and study of these organisms, as arranged by Prof. Wm. T. Sedgwick in connection with the investigations of the Massachusetts State Board of Health in 1890, is the one essentially followed in that work to-day.

For observation the micro-organisms, or plants and animals either invisible or barely visible to the naked eye, are divided into two groups, which he designates as Microscopical Organisms, and Bacterial Organisms; the former are microscopic in size or slightly larger, and by use of the microscope, studies can be made of the single individual; the latter are generally too small to be seen as an individual even under the microscope, and can only be studied in colonies, or clusters of the same species, and either by the naked eye or with the aid of a microscope. This entire and mostly invisible world of plant and animal life, he classifies as follows:

Plants......Chlorophyceae,
Cyanophyceae,
Diatomaceae,
Fungi (including Bacteria).

Animals....Crustacea,
Rotifera,
Polyzoa,
Infusoria,
Rhizopods,
Spongidae,
Miscellaneous.

The entire plant life, excepting the fungi, is frequently known as algae, but the latest classification of the biologists of the Massachusetts State Board of Health, substitutes the name algae for that of chlorophyceae alone.

The fission fungi, technically called schizomycetes, and popularly bacteria, are, as already indicated, the active agents in the spread of disease, and can be examined only in cultures; they are classified as bacilli, micrococci, and spirilla; the bacilli are shaped like rods or in straight filaments; and micrococci are spherical; and the spirilla occur in spiral filaments. Many of them are harmless and useful in the destruction of others which are the active agents in the spread of disease; some enrich the earth, some purify the water, some cleanse the air, while others yet exercise a baneful influence. The cholera germ, known as the "comma bacillus" from its resemblance in shape to the comma, belongs technically to the spirilla and is so classified by scientists; it was first discovered by Koch in 1884. The typhoid germ is frequently called the Eberth bacillus after Eberth, who announced its discovery at almost the same time as Koch in 1880. Mr. and Mrs. Percy Frankland in their volume on the micro organisms in water, state that 20 bacilli and spirilla, and 3 micrococci, each of which is pathogenic, have been found in water; their list includes tetanus and tubercolosis. Dr. Theobald Smith of the Massachusetts State Board of Health states that the water supply "is not probably at all concerned in the distribution of many infectious diseases, such as tubercolosis, diphtheria and the eruptive diseases." All investigators agree that the bacillus of typhoid and the spirillum of cholera are those most to be dreaded in the creation of epidemics. The life of the typhoid germ may extend, under favorable conditions, over several months; sunlight and temperatures higher than 133° are each detrimental to its life, while it is not affected by low temperatures and retains its life in ice; when taken into the system it will, if the individual be susceptible, produce the disease in about two weeks, although the period required for inoculation may extend to three weeks. The cholera germ does not usually live more than twenty-five days, and is less hardy when exposed to high or low temperatures than the typhoid bacillus. It is possible for the biologist to detect the cholera germ, if present in a sample, but the announcement so frequently made that the typhoid bacillus has or has not been found in a water, should not be readily accepted, as it is by no means definitely settled that this germ can be detected in water, except under special conditions. The hardiness of the typhoid germ in withstanding low temperatures, should lead to a careful inspection of the source of the ice supply, or to the use of the artificial product. Prof. Victor C. Vaughn, in reporting on the typhoid epidemics at Grand Forks, Dakota, which invariably followed outbreaks of the disease at Crookston, Minn., about sixty miles further up the Red Lake River, stated that the germs were carried by the water from the latter to the former city, where it was used for drinking purposes, the low temperature of the water, and the exclusion of light by the ice aiding in the prolongation of the life of the germs.

A singular fact concerning the germs of typhoid and cholera is that if a sample of sterilized water be inoculated with either, they will increase rapidly in number, while in natural water the disease germs seldom increase, and usually die very rapidly, being destroyed by the other organisms present. The bacillus coli communis is present in all fecal matter:

while its existence in a water is an indication of animal pollution, it has been identified in water of undoubted purity, and its presence is by no means sufficient in itself to condemn the supply. It has been suggested that the typhoid germ is possibly the result of the evolution of this baccillus. Peaty or dry soils are both deadly to the typhoid bacillus, while moist earth has a salutary effect.

Samples for bacteriological analyses are packed in ice to avoid multiplication of the germs, and the examination should be begun within forty-eight hours; these analyses, as ordinaryily reported, simply show the number of bacteria per c. c. without differentiation; an excessive quantity is indicative of sewage contamination, and when analyses are made regularly, an increase in the number leads to a suspicion of additional pollution. The number of bacteria in a water are determined by mixing the sample in measured amount, with some sterilized culture medium, such as beef tea mixed with gelatine; after a few days each of the bacteria have multiplied into a large family called a colony, many of which can be readily detected by the naked eye; a close examination reveals the total number present. The number present in a water varies with the seasons, and with the depth below the surface from which the sample is taken; they are usually more abundant in winter and after storms. Miquel has classified drinking water in its relation to disease as follows:

Excessively pure, 0 to 10 bacteria per c. c.
Very pure, 10 to 100 bacteria per c. c.
Pure, 100 to 1,000 bacteria per c. c.
Mediocre, 1,000 to 10,000 bacteria per c. c.
Impure, 10,000 to 100,000 bacteria per c. c.
Very Impure, from 100,000 bacteria per c c. upwards.

Dr. Theobald Smith states that "ground water, as it issues from the earth in springs, is nearly free from bacteria. But as it runs over the ground it becomes more or less contaminated with bacteria from the surface of the soil. In spring water there may be from 0 to 50 bacteria in a cubic centimetre (about one five-hundredth pint). As this water collects in pools and goes to form streams, the number may rise to 500 or even 1,000 without necessarily implying contamination with excreta and other animal remains." Ordinary boiling for one half hour will render a water sterile to the extent of destroying 99 per cent. of the bacteria, while at the boiling point all of the pathogenic types perish.

In most of our large cities there are periods of more or less regularity and frequency, when the water supply is alleged to have objectionable color, offensive odor, unpleasant taste, or all of these qualities combined. At such times it is usual for press, pulpit, and layman to denounce the supply and allege all manner of contamination, invariably dependent upon gross sewage pollution and improper protection of the supply, and just so often is the entire corps of water works officials driven to their utmost resources in resisting such a host, by disproving the assertions and establishing the fact that, except in the objectionable quality complained of, no unusual condition obtains other than existed at times when the supply was acceptable to all. The history of many of these cases shows that the difficulty vanished almost as suddenly as it came, sometimes before any remedy could be applied. and sometimes through efforts based on experiments of various kinds, each of which latter often resulting in increasing the expedients to be resorted to under similar conditions, but none yet have prepared the general public to tolerate subsequent repetition in a more charitable or scientific manner.

In Massachusetts this difficulty has been particularly marked and has led to a close observation of the causes by the State Board of Health, which with the investigations of interested biologists at home and abroad, has given us a much better insight into the nature of the objectionable condition, which has been established beyond question as due to the life or death of the microscopical organisms contained in the water. In 1889, Mr. Geo. W. Rafter, C. E., wrote that "knowledge of the sanitary significance of many of the minute forms of plant life inhabiting our water supplies is very limited, and it is only when some special reason exists that students direct their attention to the sanitary side of the question. This is the more remarkable when we consider the amount of energy that has been expended in study from the purely botanical point of view." Since this date great progress has been made. but the field for discovery is yet entirely too large, while the opportunities for investigation are few except when made at personal expense for purely scientific purposes. Mr. Gary N. Calkins, Asst. Biologist of the Massachusetts State Board of Health, in a report on "Odors observed in the drinking waters of Massachusetts," after calling attention to the fact that "most so-called 'tastes' are really odors," proceeds to discuss the analyses made of 1404 samples from reservoirs. lakes. ponds. rivers and brook (all surface waters or ground water stored in reservoirs), in the State of Massachusetts distinguishing the odors as vegetable, sweetish, aromatic, grassy, mouldy, fishy, disagreeable, offensive. musty, and earthy, these comprising the usual category of complaints. The samples containing organisms belonging to one classification only. were considered separately with the following results:

Organism.	Number of samples examined.	Number of samples containing odor.
Cyanophyceae,	85	82
Algae,	25	23
Fungi,	286	240
None,	384	218
Diatomaceae,	174	148
Infusoria,	79	77

The balance of the samples contained organisms of more than one class. The odors observed in the samples containing no organisms, are obviously due to previously existing organic matter. The odors of the samples examined, were in proportion as follows:

Vegetable,	26%
Grassy,	14%
Mouldy,	10%
Offensive,	7%
Disagreeable,	6%
Aromatic,	6%
Sweetish,	6%
Fishy,	3%
None,	20%

Mr. Calkins concludes from his examination that odors may come "(1) from the excretion of certain body products, (2) from the liberation of certain internal substances, (3) from the bacterial decomposition of their dead bodies."

Mr. G. H. Parker. Biologist of the Board, has noted that, while one water may have a perceptible odor, another sample containing the same organisms in the same quantity may differ by entire absence of odor, from which he established the conclusion that the odor is due to the death of the organisms; another observer reaches the same deduction on the ground that the variety of odors in water, is small in proportion to the variety of known organisms. The particular odor resulting from the life or decay of various organisms and combinations of organisms is still being studied, but under the great variety of conditions experienced at various places where odors are noticed, it is still an impossible matter to predicate by name the responsible plant or animal, without a long-continued study of the water affected. It has, however, been fairly well ascertained that, while water under these conditions may be decidedly objectionable from an aesthetic point of view, it is not prejudicial to health if the consumer is not particular concerning the appearance or odor of his beverage.

Experience has taught that sub-surface or deep well waters, when exposed to light, are frequently subject to excessive growths of odor-producing microscopical organisms; also that the surface water and the lower stagnant stratum of deep reservoirs interchange their position by reason of gravity with the change of seasons, the upper stratum carrying oxygen which stimulates the growth of the organic matter at the bottom but is quickly consumed with resultant putrefaction and odors; conditions like those first mentioned often lead to the covering of storage reservoirs, thus excluding light, while in the latter case, where the difficulty is frequently of periodical recurrence, the ultimate remedy is to cleanse the reservoir bottom. In Massachusetts it was found that waters low in color were particularly subject to odors. The vegetable matter in water receives its nourishment from the free ammonia and nitrates present, and the abundance of these, as shown by chemical analysis, is a ready guide in ascertaining the quantity of contained micro-organisms. The animal life is in its turn sustained by the plant life or by other animals of a lower order, and by death and decay furnish fresh material for the circuit. The number of microscopic organisms present in a water is determined by passing a measured amount of it through a filter, and washing, with a much smaller and measured amount of sterile water. the retained organisms into a cell; this concentrates the organisms into a very small compass, where they are counted under a microscope.

As further progress is made in the study of the micro-organisms, it is to be sincerely hoped that it will be found possible to so protect our water supplies at all times, that the objectionable colors and odors now so frequently complained of, if not entirely avoided, may at least be of brief duration.

In determining the quality of the supply it is now apparent that the Engineer, Chemist and Biologist must work in harmony, and that the problem is one frequently subjected to ever changing conditions, and often far from simple; it sometimes happens that an inspection of the water shed is all that may be required to determine the potability of the water, but in these days when man is constantly reaching out into what were formerly waste and barren lands, and converting them into places suitable for his abode, the sources of water supply are becoming more and more subject to contamination and will require an ever increasing vigilance in their protection. Chemical, microscopical, and bacteriological analyses must not be treated as independently conclusive, but each as only a part of the necessary steps in obtaining a complete knowledge of the supply.

THE PRESIDENT: The next paper on water and the last one on this morning's program, is by Mr. Sherrerd, of Newark.

MR. SHERRERD: Gentlemen of the Convention, I will say that at Mr. Van Duyne's request, knowing that they had considerable trouble with the water supply of Brooklyn, due to the objectionable color, odor and taste of the water, I wrote to and received an answer from Mr. De Verona, the engineer, that he had just made a report on the subject. He did not have time to send in a paper but he gave me the privilege of editing the report. I want it to go into the record, but at the present time I do not think it will be necessary to read it all and if the President desires, I will read some parts of it.

Mr. Sherrerd then read from the following reports:

SOME FEATURES OF THE BROOKLYN WATER SUPPLY AS PRESENTED BY. I. M. DE VERONA, ENG'R OF WATER SUPPLY IN A RECENT REPORT.

REARRANGED BY M. R. SHERRERD, ENGINEER WATER DEPARTMENT, NEWARK, N. J.

The past summer seems to have been particularly productive and successful in producing the condition in stored water which is favorable for the growth of organisms. Brooklyn, N. Y., among other cities has found that its water supply was seriously affected. The condition of the water was such as to give rise to serious complaint. Mr. I. M. De Verona, Engineer of Water Supply of that City, has kindly consented to allow the use of his report lately made, on this subject, and I have taken the liberty to abstract some parts of the same which may be of interest to the Comvention. Many of the members have, no doubt, seen the report in print, but it would seem advisable to make it a matter of record in our publication. The report is written in answer to a series of questions asking for the cause, remedy, etc., of the recent complaints as to the quality of the water. Mr. De Verona says:

"A specific determination and location of the cause of the trouble necessarily involves the exact differentiation of the micro-organisms (vegetable or animal) which produced the bad odor, taste and color of the water, and a clear exposition of their mode of operation, whether singly or in combination, or whether in streams, ponds, driven well stations, reservoir or distributing system, as well as the precise statement, if the cause originate in the supply of the particular sources affected."

He refers to a report of the Health Commissioner in which it was stated that the bad odor and color of the water were due to the presence of living and decomposing vegetable matters in the ponds, reservoirs and distributing system. This did not sufficiently specify, nor did it locate the cause of the trouble. A supplementary report gave the results of a physical inspection of the ponds but did not include some of the reservoirs nor driven well stations. In this report it was taken for granted that the trouble was exclusively due to the surface supply and no mention made of the driven well stations. It was believed that the origin of the disagreeable color, taste and smell of the water, was due to the decayed vegetable matter and parasites infesting this mass of dead material. Further reports and bacteriological examinations gave quantitative determination of the bacteria, and a means of comparison of the waters from the several ponds, but did not locate the specific cause of the trouble nor determine the exact ponds where the same originated. Physical examinations indicated that the air blowing over the ponds had the odor characteristic of decaying weeds, and seemed to indicate that the condition of these ponds was responsible for the foul condition of the water. Further extended examination led to the conclusion that while the objectionable odor was apparent along the sides of the ponds, the water as it left the same was not noticeably affected, certainly not to the degree necessary to account for its condition as found in the distributing system. Mr. De Verona did not, however, maintain that there was not something in this water which developed an objectionable odor, color and taste after leaving the ponds.

He refers to Prof Leeds' investigation, which was directed to determine whether the cause of the objectionable color, taste and odor existed in the distributing system or in the sources of supply. The conclusion was that it originated in the latter, but the investigation did not proceed far enough to determine its precise location.

"Prof. Leeds' analysis showed an abundance of nitrates in the water both at the tap and distributing system, which indicated that 'the decomposible albuminous principles had largely disappeared and that the water was in a condition ripe for a rapid propagation of whatever form of equatic growth happened to be present, and found the environment best adapted to its particular needs.' His investigations led him to surmise that the 'trouble arose from the exposure to air and light of the driven well water * * * * * the waters in passing through the pores of the soil, acting as filters, having had their organic nitrogen removed. They usually contained few if any bacteria, since these have either been detained in the pores of the surface soil, or, their work having been performed, they had perished for lack of nutriment. But such purified deep well waters, when brought to the surface and then seeded by mingling with the surface waters, the seeds of new life have a most abundant nutriment, and having no organisms previously present to contend with them in the fierce struggle for existence, often multiply with inconceivable profusion.' "

On account of this peculiar condition of affairs Prof. Leeds concluded that aeration would not be of much value in this particular case but recommended the necessity of obtaining further chemical, microscopical and bacteriological data by a systematic study. Mr. De Verona in summing up the conclusions arrived at from the several expert examinations, was still unable to specifically determine and locate the cause of the difficulty, and it seems conclusive that only by a long series of careful analysis and examinations will it be possible to arrive at a successful remedy to be applied. It is certainly true that complaints from this cause are a matter of frequent occurrence and have been experienced in many of our cities. He refers to numerous instances of similar objectionable states of water supplies in other cities; as the same are of special interest they are here given.

BOSTON.—Mr. Fteley states in the report of the Massachusetts State Board of Health for 1879 that "sulphuretted hydrogen was present in Basin No. 3 in such quantity as to be plainly perceptible to the sense of smell, while the water was passing through the sluice gates" and that algae were numerous in the basin at the time, although a uniform temperature throughout the whole depth of the water was preserved. He adds that during the first year, after filling the new reservoirs of the Sudbury water shed, sulphuretted hydrogen was found during July and August" and could be plainly preceived when the water was flowing through the sluice gates. The smell of the gas disappeared after a short exposure of the water to the air, and none of it was ever detected in the conduits." In regard to the algae, he remarks that "only in the fresh state they emit a peculiar musty odor. If stranded by the action of the wind they soon decay and form a bluish green mass which develops a smell as of organic matter in process of decomposition. When in the water the algae remain suspended for some time and after a while sink to the bottom." The green scum collected from the reservoirs thus affected after standing and given opportunity for the plant life to decay emits "an extreme offensive odor of decomposition, which increases as the plants decay and lose gradually their characteristic form." In 1881 the the water of Farm Pond near Boston became affected with a bad taste: in this case the trouble was attributed to the presence of a sponge.

NEW YORK.—In 1881 diatoms appeared in the head waters of the Croton and twenty days after entirely disappeared, but soon after the disappearance, the tap water was pervaded by an unpleasant odor. Prof, Waller states that the testimony as to the prevalence of odor in dead ends of the distribution system is conflicting.

JAMESTOWN, N. Y.—In 1886 the water furnished by the Jamestown Water Supply Company mostly from driven wells became affected by strong odors of decayed fish and vegetable matter, thick and muddy. Examinations were made by several chemists, none of whom reported any bad taste or odor, with the exception of Prof. Leeds, who stated they were due to the driven well water and recommended either aeration of the water or covering of the reservoirs. The latter course was pursued, but the quality of the water was not improved thereby.

ROCHESTER, N. Y.—In 1888 Mr. Rafter reports that samples gathered round the margins of Hemlock Lake gave a vile pig-pen odor, which from his investigations he was led to believe was due to the presence of certain diatoms. Mr. J. Nelson Tubbs, Chief Engineer of the Works, has stated that several years before "a similar deposit was so extensive as to cause an unpleasant odor for several feet from the Lake."

During the time referred to by Mr. Tubbs, the water itself was not affected, the odor arising entirely from the decay of algae scattered along the beach. Mr. Emil Kuichling states that during the warm season in 1876 and the cold season in 1888, odors were noticed in the water. By some investigators the difficulty was attributed to a variety of minute algae and by others to volvox. On May 10th, 1889, Mr. Rafter observed the growth of algae at the Mt. Hope reservoir and on May 22nd and 23rd complaint was made by the consumers that the water tasted fishy and had a bad odor. It was found that the growth of algae which Mr. Rafter defines, had changed since his first observation into a mass of compact jelly, which he considers due to the growth of volvox globator.

NEW HAVEN, CT.—In 1874 after an appearance of odors every summer in the water supply for several years there was a recurrence more offensive than ever before; the difficulty was here attributed to failure in cleaning the reservoir site.

HOBOKEN, N. J.—Mr. Chas. B. Brush states that the water of Hoboken furnished by the Hackensack Water Company became in 1884 so bad that great excitement prevailed, that the Mayor of the City called public meetings and he was informed that he was expected to explain why the water was bad and to remedy it or suffer the consequence, but that after aeration, upon the recommendation of Prof. Leeds, they have had no further difficulty. During the time when it was offensive there was a green to bluish scum on the surface of the water which remained during the time when the odors were perceptible.

At the outset of the Brooklyn trouble Mr. De Verona stated his belief that the cause of the complaint might possibly be due to exposure of the driven well water to light and air and its admixture with that from the surface supply. His view, which is supported by Prof. Leeds' examination, was not based on what had occurred in other cities, but from the actual condition of their ponds; since while susceptible of further improvements they are much better than for a number of years past, due to the work of cleaning the ponds and protecting the streams, which had been done during the last three years.

In summing up this part of this report, while admitting just ground for many of the complaints received he states that "the matter has been unquestionably exaggerated and misunderstood," but that it would be well for the City to have a laboratory of its own, and that constant, continuous and systematic examination of the water from the various sources be made somewhat on the lines now pursued at Boston, "where all records of tests are carefully recorded in suitable books and the results are also plotted on cross-section paper." In this way comparisons on the quality of the water for the same periods of different years are easily made, and adds that the cost of the instruments required for the laboratory, for color tests and biological work and of the building (if erected on the line) would not exceed $5.000. If established in the municipal building, the total cost of installation would not exceed, probably, $4.000.

The work which the Department of City Works must do to protect its water supply, in no way interferes with the duties of the Board of Health, who remain always free to exercise their powers of inspection in whatever direction they may see fit for the protection of public health.

In answer to the question, "What general measures are required to protect our water supply from pollution?" Mr. De Verona suggests "The continued observation, examination and analysis of all our sources of supply already described, so that we may become thoroughly familiar with their characteristics and the most efficient treatment or management in any given case; the strict enforcements of the State Board of Health for the protection of water supplies and their modification so as to enlarge the powers of the local boards and render their action more efficient against transgressors, and the purchase of land and buildings where the application of the foregoing rules and regulations is not sufficient to protect the stream."

In regard to quality of water the following appropriate remarks are given: "The best possible quality of water varies with the standard, which rises with the constant progress of sanitary science, and the difficulty of maintaining such a standard increases, therefore, from year to year. To this difficulty, which is a general one, may be added that arising from the effect of the rapid settlement and increase in population throughout a water shed, and its effects in polluting the streams could only be avoided totally by a wholesome purchase of land along such streams far beyond the financial resources generally available. Under these conditions, the course hitherto pursued has necessarily been to utilize the streams as originally bought as long as it was safe to do so, and to affect such purchases as were subsequently required to prevent dangerous pollution. How long this mode of operation may be continued is obviously uncertain. Should a point be reached at which the pollution of the water becomes dangerous and the land and buildings to be purchased or works to be erected to prevent it too costly, the only sure remedy will be sand filtration. The idea of filtered water conveys, to many, suggestions which are not pleasant to speculate upon. Yet, it is the only sure and scientific mode of treatment, and it is fair to say that within a few years it will reach in this country the same development that it has already attained in Europe. He estimated that the establishment of sand filter beds for a supply of 100,000,000 gallons daily would increase the cost per million gallons, if the beds were uncovered about $12, and if the beds were covered about $16. The approximate cost of installation would probably be about $1,700,000 with uncovered beds and say $1,000,0000 more if the beds were covered. In regard to the length of time the city could rely upon its present plant, Mr. De Verona says in part (stating that the present plant could probably be relied upon for five years): "The question is largely dependent on the management of the distribution, through which a difference of several million gallons a day may readily be made. This brings us to another question germane to this subject, which is that of the compulsory use of meters. The idea that water should be as free as air is very general and pleasing, but unfortunately untenable, as the water supply is limited and the difficulties of adequately providing it, increases from day to day. It should be judiciously regulated by proper measurement. The introduction of the meter system with its house to house inspection has excited in the past considerable opposition among our citizens and is repugnant to a large number of them. While this is a serious drawback, public sentiment, enlightened on the necessity of some check on the unjustifiable waste of water now prevalent, would ultimately support a measure tending to check this useless expense. A more valid objection against the introduction of meters is their tendency to reduce, from penurious motives, the amount of water used by the poorer classes in the tenement districts, where often none too much is used now and where it is mostly needed; thus seriously endangering the public health. This peril, however, might be avoided by establishing a fixed minimum rate, to be paid for each class of buildings, and which would be based on the amount of water, liberally calculated, which should be used, taking into account the number and occupation of the tenants. For this fixed minimum rate the charge should be low, and for any excess much higher. The arguments for and against the compulsory use of meters have been so frequently and exhaustively stated, that it would be superfluous to reproduce them here. To give an idea of the propositions of the waste of water above alluded to, it may be stated that in the plans recently prepared for the supply to Greater London, involving according to the report of A. R. Binney, Chief Engineer to the London County Council, an expenditure of nearly $200,000,000. Thirty-five (35) Imperial gallons (or nearly 42 U. S. gallons) was fixed upon as an allowance per capita. Mr. Jas. Mansbergh, C. E., Member of the Royal Commission, which reported on this plan to supply London, states as follows: "The recent

Royal Commission found that, in the year 1891, the average daily quantity supplied per head in Greater London was 32.68 gallons (about 39 U. S. gallons) and after hearing such evidence from all sides, and fully considering the matter, they fixed on 35 gallons (about 42 U. S. gallons) as an ample quantity for all purposes, domestic, sanitary, trade and ornamental, and, I think it may safely be stated, that this is more than the average consumption in the whole of the United Kingdom. Mr. Mansbergh in his exhaustive report for the supply of Toronto, Canada, published this year, after fully discussing the subject, adds that 25 Imperial gallons (about 30 U. S. gallons) is in Great Britain "nowadays never exceeded and very rarely reached in laying the estimates of cousumption before Parliamentary Committees; it is, in fact, admitted on all hands to be a very full and ample provision for all domestic and sanitary purposes." He adds that "from 45 to 50 gallons (from 45 to 60 U. S. gallons) ought to suffice for Toronto." In our American communities the consumption per capita and the waste, are much larger than in European cities; but, even after fully allowing for this fact, 60 gallons per head should be ample in all but exceptional cases. For Brooklyn it may certainly be stated that 75 U. S. gallons per head is a more than liberal allowance for all purposes, including even more or less excusable waste, and that any excess over that figure simply represents imperfect work, mal-administration or reckless waste."

THE PRESIDENT: I wish to say that, as we are expected to vacate this room at one o'clock, the afternoon session will take place in the Club Room on Floor L at the Great Northern Hotel, and as there is quite a little work laid out for this afternoon, I will kindly request you to be promptly on hand, so that the business may be taken up. I wish to state that the banquet will take place in this room at half past six o'clock this evening. As the hall is getting empty I think we had better continue the discussion upon the papers we have just had at the afternoon session.

OUTAGES.

J. A. CABOT, CITY ELECTRICIAN, CINCINNATI, O.

As this word cannot be found in Webster's Dictionary, it will no doubt be necessary to define it, as it is pure Cincinnatus. It will take a Cincinnatian to do it. This word is used in Cincinnati to designate the time an electric lamp is not burning.

The outage of an electric lamp is a difficult problem to solve; it has caused more trouble than any two problems in city lighting in our city. From the answers given in the question sheets returned to the Committee on Electric Street Lighting, I take it that outages are not given the care and thought they require; it stands to reason that they are not, when a city will return an answer like this—"We let the Company bulldoze us and they do it."

The City of Cincinnati has gone to a great deal of trouble and expense to keep tab on all outrages; but under the contract we can only do certain things to keep all the lamps burning. Cincinnati has a peculiarly constructed clause providing for the report of outages; the principal motive for this system of reporting outages is to have all the lamps burning at all hours according to schedule.

The clause governing this is as follows:

(EXTRACT FROM CONTRACT. Sec. 12.)

"All outages shall be reported by the Police to the Central Lighting Station. The contractor, under these specifications, shall have one hour after the report reaches the station in which the renew any lamp reported as out. If the lamp shall not be lighted within an hour after being reported at station to be out, the Policeman noticing same shall keep account of the number of hours said lamp is allowed to remain out, which outage shall be reported to the Superintendent of Police, who will report the same to the Board of Administration."

Our outages became so numerous and ran up into the thousands, that the Board of Administration found it necessary to pass the following:

RESOLUTION OF THE BOARD OF ADMINISTRATION,

January 16, 1896.

"Whereas, Numerous controversies have arisen between the City of Cincinnati, through its Board of Administration, and the Cincinnati Edison Electric Company, relative to the provisions of the contract for lighting the various districts of the city with electricity, and the reporting and allowance for outage thereunder; and,

"Whereas, In the opinion of this Board a system must be adopted that will insure prompt reports to said Company of such outages in order that they may receive immediate attention, that the interest of the city and the community may be properly protected, and to the end that the outages complained of shall be reduced to the minimum, and corresponding reductions made in the charges for lighting; therefore, be it

"Resolved, That the Police Department of the City of Cincinnati be, and it is hereby, requested to authorize and permit the employment by the Board of Administration of two operators, to be stationed at the Central Police Telephone Exchange of the City of Cincinnati, between the hours of 4 o'clock p. m. and 8 o'clock a. m., the sole duties of such operators to be the receiving from the Police Department, its officers, and such other employes as may be charged with the duty of looking after and reporting such outages as may occur, the transmittal of said reports immediately to the Central Lighting Station of said Company, or over a line to be constructed by the City, and to be especially devoted to such purpose, the keeping of a complete record of such reported outages, and the submittal to the Board of Administration and the contracting company, of tabulated statements showing such outages as reported both as individual isolated lamps, circuits, or a great number of lamps, and also as to time and number of lamps affected by said outage, whether the time of such outage continue for one or more hours, or for less periods than an hour; and be it further

"Resolved, That the Mayor be, and he is hereby, requested to arrange for the assignment of said operators, and to instruct the Police Department through its Superintendent and Officers, to make reports of all outages occurring in the city, in conformity with the provisions of the foregoing resolution."

We have four different printed forms used by the Police, who are obliged by contract to report outages; the operators who have been appointed per resolution above to receive and transmit these outages have a recapitulation sheet used at the end of every month, and a form for each individual outage, as it occurs during the month. To facilitate in the rapidity of reporting lamps when out, we have each of our electric light districts divided into sub-districts, and each lamp in each sub-district numbered accordingly; starting with sub-district 0, the lamps will be found to number from one to eighty-five, ninety, or whatever it may be; then sub-district 1, will vary from one hundred and one to one hundred and eighty-five, one hundred and ninety more or less according to the number of lamps in the sub-district, etc., for each sub-district; sub-district No. 2 starting with 200, etc.

The sub-districts are determined by the number of lamps in each district, making those streets act as boundary lines, which will enable us to put from 85 to 90 lamps to a sub-district. Our idea in dividing a district into sections of 85 to 90 lamps is to enable us at any future time to place additional lights at any part of the City without going to the extra expense and labor of renumbering all poles and still have all numbers of the same hundred in the same locality.

The police when reporting a lamp out are only obliged to ring up the Police Telephone Exchange and mention the number; the Exchange makes note of this lamp out on a form sheet identical with the one used by the city operators stationed in the City Electrician's office. The Exchange then rings up the city operators and mentions the same number that has been reported by the police. Operator makes note of this outage on his sheet and changes his switch that connects him directly over a private wire with the contracting Company, and reports the same number as before; this for each and every outage unless more than one lamp has been found out, and reported by the same policeman at the same time. The Company makes note of this number and refers to their map with each lamp numbered and its location (a copy of which is in City Electrician's office) and proceeds to cut lamp in.

The following morning the police send in a report on sheet prepared for this purpose, stating each lamp out when reported by number, when found out, and when cut in; if globe or lamp has been injured and name of officer that reported same. This sheet is then "checked up" with the report received by the operator during the night, and time lamps were out is added to a special column on operator's sheets.

The Police Exchange likewise submits a duplicate (of the lamps reported to them during the night) to the Electrical Department, which is likewise compared with the report received by the operator during the night.

A duplicate of the operator's report is then sent to the Company, who compare same with their report, and forwards to the city a typewritten report of their acknowledgment, time deducted, etc.

To make this more clear, we will proceed with an example:

Lamp No. 5 is noticed by policeman to be out at 8 P. M. He proceeds to nearest telephone box and rings up the Police Exchange, which being connected with each of these telephone boxes answers without compelling the officer to call up the Central Exchange. The officer simply mentions the number "Five," and closes the telephone box, at the same time noting the fact that lamp No. 5 was found out at 8 P. M., and reported to Exchange at 8:02 P. M. or 8:03 P. M., whatever time it may have been. Police Exchange makes note of this lamp, likewise the time he received report of said outages, which must correspond to officer's time of reporting.

The Exchange then rings up the operator situated in city building with Police Exchange, and simply mentions the number "Five," and then the time he reports same. The operator then reverses his switch, rings the bell and reports No. 5 to the contracting Company, at the same time noting the time he received the outage from Exchange, which must correspond to the Exchange report in the morning, and the time he transmitted same to Company. The Company takes time of this number, enters time of its receipt, refers to their map and finds lamp No. 5 situated in sub-district No. o—(since it is not in the hundreds), and finds lamp to be at such and such a corner,—then the trouble-man proceeds to cut lamp in, making note of time lamp starts up, which must correspond to Police Report in the morning. At the end of each month a tabulated sheet is drawn up showing the number of hours of "outage" reported by the police, the total of the operator's report, (which necessarily will be less than the police report owing to delay in telephoning) the difference between the reports of police and operator, the Company's acknowledgment, and the difference between Police Report and Company's acknowledgment.

A deduction is made from Company's bill at the rate of two cents and two mills per hour for each hour out, taking Company's acknowledgement for this reduction.

Then another sheet of different form is made out, showing the number of times each individual outage has been reported, and the length of time each lamp has been out during the entire month. This sheet is forwarded to the Company, who have agreed to replace with a new lamp all lamps found out more than three times per month.

Although this method seems to be a good one, it is not perfect by any means. There will be quite a few misunderstandings through the telephone, that cannot be remedied. The police will report a lamp out at night, and fail to make a written report of same in the morning; then, again, an entire circuit will go out, and it will be impossible for one officer to get all of the lamps on the circuit, watch single lamps, and at the same time attend to his other duties.

"At the annual convention of the National Electric Light Association held in Cleveland in February, 1895, a special Committee on the rating of arc lamps submitted a report, which was adopted and ordered printed in full in the standard rules of the Association. The report reads as follows:

> "Recognizing the difficulty, if not the impossibility, of measuring with any degree of accuracy the illuminating power of the arc lamp and the great necessity for a more precise definition and statement of the obligation of the producer of electricity for illuminating purposes to the consumer thereof, be it
>
> "Resolved, That in the opinion of this convention what is ordinarily known as a 2000 candle power arc lamp is one requiring on the average 450 watts for its maintenance, measurements being made at the lamp terminals, where no sensible resistance is included in series with the arc; in case such resistance is used, it must be excluded in the measurements of the voltage.
>
> "Measurement of wattage, provided for in the resolution of the Committee on the rating of arc lamps, appears to be the true solution of the problem. To quote Captain William Brophy; "The sooner you sell your light as power the sooner this trouble will end; and I advise every man in the future to sell his lamp at 450 watts, or whatever is necessary and bury out of sight the term '2,000 candle-power.' "

I think this is the only proper method for cities to buy light.

For the benefit of those cities who have short term contracts, I would suggest, that when new contracts are entered into, the contract be based on electrical consumption. If 450 watts be the maximum energy supplied to each lamp in order to make sure that the city is getting what it pays for, each and every circuit should have in it a recording ampere and vote meter. If recording meters be used, the city will have an indisputable daily record of the energy supplied to the lamps by the use of these recording meters, the burden of reporting outages will be taken from the Police Department. The Police have enough to do with the additional burden imposed upon them of reporting lamps out. T burden should be assumed by the contractor furnishing light. If cont specifies that recording meters be used and deductions for shortage outage be made according to their reading the Company will sup the means to keep the lamps burning and up to the prescribed stand when they know that any shortage will reduce their revenue.

Figure 1 is an enlarged copy of one of the charts of an "Recor Ampere-Meter." The red lines is a fac-simile of the record made by of these ampere-meters at the station of the "Brush Arc Light C pany" in New York City.

Figure 2 is a diagram showing machine recording ampere-me connecting plugs, and circuit of arc lamps.

Figure 3 shows the shadow thrown by an "Eliptical Carbon."

The following resolution was offered by Mr. Brockm of Milwaukee:

"Resolved, That the Secretary be directed to send a co of the proceedings of this meeting, when printed, to all of t Mayors of cities represented in this Society with the requ that the same be transmitted by them to the Council of th respective cities."

On motion the foregoing resolution was unanimou adopted.

The convention adjourned until 2 o'clock P. M.

FRIDAY, OCTOBER 16th, 1896. AFTERNOON.

The convention was called to order at 2 P. M. in the cl room of the Great Northern Hotel by President Herrmann.

The following paper was read by Mr. M. R. Sherrerd, Eng neer Department Water Works, Newark, New Jersey.

NEWARK'S GRAVITY SUPPLY AND STEEL CONDUITS.

M. R. SHERRERD, ENGINEER WATER DEPARTMENT, NEWARK, N. J.

Newark's water supply is obtained by gravity from a drainage area 62½ sq. miles situated on the headwaters of the Pequannock River, branch of the Passaic River. A general description of the plant w given by Mr. Bailey last year, and it is the purpose of this article o to deal with recent developments and incidents in connection with t supply.

The initial gravity plant was built in 1890-91 by the East Jersey Water Company under a contract to obtain certain definite results, among which was the supplying of the City of Newark with water up to a maximum quantity of 27½ million gallons daily until 1900, at which time the completed plant is to be turned over to the City. Having a conduit and storage capacity of 50 million gallons daily, in the meantime the Company have the option to sell the amount of water in excess of the City of Newark's needs until 1900. The work done upon this plant in 1890, '91 and '92 consisted in the building of two storage reservoirs, an intake dam, and 21 miles of 48″ riveted steel conduit from the intake dam to the distributing reservoir with a branch from the same of 5 miles of 36″ riveted steel pipe to the High Service reservoir; one storage reservoir having a drainage area of 9½ sq. miles and a capacity of 3500 million gallons, the other storage reservoir having a drainage area of 27 sq. miles and a storage capacity of 2500 million gallons, and the intake dam with a drainage area especially appurtenant to it of 26 sq. miles, making with the drainage areas of the storage reservoirs a total drainage area as mentioned before, namely, 62½ sq. miles. The requirements of the contract as to the height of delivery together with the selected location for the intake dam and the location of the conduit line give a hydraulic grade of 2 ft., in a thousand feet for the 48″ line.

Until the present year no tests of the carrying capacity of this conduit were made when working under cointract requirements, but constant records were kept of the yield of the watershed both by the Company and the City. During the present year, however, tests of the pipe line have developed its capacity to be much less than the contract requirement, and the storage capacity in the watershed has also been proven to be defficient. The company has undertaken to remedy both of these conditions, and an additional conduit has been laid and work is nearing completion upon the construction of dams which will give a greatly increased storage capacity. The noticeable defficiency in the carrying capacity of this first line of the East Jersey Water Company below what was at first maintained that it would carry, has given rise to numerous discussions of the "I told you so" variety. It seems quite apparent from developments that the Company has known for a long time, if indeed it was not from the first expected that the 48″ line would not carry to exceed 44 million gallons, and the startling feature has been the apparently rapid deterioration in carrying capacity in four years from this amount to 36 million gallons as developed the first of this year.

It is certainly true that little reliable information in regard to the carrying capacity of long lines of riveted steel pipe was available at the time the design for this work was made, and it is almost fair to say that this is the first line of the kind, and certainly the first equaling it in length upon which continuous experiments and accurate measurements of the flow have been made. During February of the present year the actual amount of water carried by this 48" line when running full to the first hydraulic summit was 36 million gallons, which would correspond to a coefficient of roughness in Kutter's Formula of the flow of water in pipes" to .0143. During the first few days in March of this year great difficulty was experienced at the intake in keeping the gate chambers and the pipe itself free from anchor ice, which formed for three nights in such quantities as to materially stop the flow of water through the screens, and in changing screens some ice necessarily got in the pipe. On the fourth day when the pipe was again running with an uninterrupted flow, the deliver ran as high as 37 2-10 million gallons. There seems to be little doubt but that the scraping of the growth of algae from the inside of the pipe, at least near the intake end where the growth was no doubt more luxuriant, has resulted in increasing the flow. Similar treatment might be suggested as good medicine to give a pipe line under similar circumstances when it could not be shut off for a sufficient length of time to allow cleaning.

While the pipe lines are constructed to work under a head equivalent to the high service delivery, yet the location and height of the main distributing reservoir taken in conjunction with the profile of the pipe line, suggested the advisability of constructing a second pipe line 48 inches in size for the first 5 miles and the remaining 16 miles 42 inches in size. This is not, therefore, exactly a duplicate line, but will be quite as advantageous when used for delivery at the lower reservoir. The work upon the last line is just being completed, and unfortunately I am unable to give exact figures as to its carrying capacity. It may be interesting to note that where the interior of the steel conduits have been examined, while a very slight growth of tubercles is apparent, they were not as numerous or as large as would be found on cast-iron pipe after being laid for the same number of years. The steel pipes for these conduits were carefully dipped while hot in an asphaltic preparation and gave a very smooth and tenacious coating. During the construction of the second line it became necessary to uncover the original line in many places, and the coating was found to be in splendid condition and no indications of rust were apparent (with the exeception of such points where slight leaks had occurred) even where the asphaltic coating had been rubbed off by the workmen, and when removed in flakes by a knife there seemed to be a slight brownish skin upon the steel which is evidently equivalent to a secondary coating in itself and is probably due to a chemical action which takes place when the hot pipes are dipped in the asphaltic bath, as this condition would facilitate the combination of Sesque-oxide of iron with the Proto-oxide or what would chemically be equivalent to $Fe_2 o_3 + Fe\ o$ giving $Fe_3\ o_4$ a more stable compound which prevents the further oxidization of the steel, or, in other words, prevents the continuation of the formation of rust.

A brief description of the method employed in the manufacture and laying of the second steel line may be of interest. All circular joints were made with what may be called the bell end up stream. They were made in the shop in lengths of nearly 30 feet, each length being composed of four plates. The work was very similar to boiler construction and the joints were caulked inside and out. Each 30 foot sections were tested under pressure in the shop.

After delivery along the line of the work, two sections were generally riveted together before being lowered into the ditch, after which the continuous line was riveted together, the hot rivets being dropped inside the pipe through a 1½" tap, and the rivet heads of the upper part of the circular seams were made by driving the head on the outside, and for the under part driving on the inside. Joints were then caulked and plugs inserted into the hole through which the rivets had been dropped. The pipe was generaly covered between "field joints" and when sections of the line were completed a "dead" cap was put in the end, and pressure tnrned on to test the new line; any necessary caulking being done where leaks occurred. The new and old lines are connected at advantageous points so that sections of either line may be temporarily cut out of use for repairs and examination. No expansion joints were used on either line. The changes in direction and adhesion of the earth seem to be sufficient to prevent any serious trouble from expansion. The lines are supplied with Venturi meters and constant records are kept of the flow through the conduits. During the past year 21 miles of new conduits have been laid, and in June work was begun upon new storage reservoir dams. This work has progressed day and night, and the indications are that the earth dam, which is about 700 ft. long and 60 ft. high, will be completed in November, and the spill-way dam, some 300 ft. long and 35 ft. high, of stone, is nearly completed. From a thousand to thirteen hundred men have been employed on this work, and I believe it is the first time an earth dam of these dimensions has ever been completed in one season.

The following report of the Finance Committee was then read by Mr. Rundlett, the Chairman:

Chicago, Oct. 16th, 1896.

To The American Society of Municipal Improvements:

Your Finance Committee herewith submit the following report, supplementary to their report of October 14th:

In addition to the expenditures for the year as set forth in the Treasurer's report, we find the following liabilities which still remain to be paid:

Secretary's salary	$100.00
Certificates of membership	125.00
Secretary's expenses for postage, telegrams, etc	22.09
Secretary's expenses for printing, books and stationery	57.25
Expenses incurred by the Executive Committee in arranging for reduced railroad fares, etc	21.20
Estimated expenses incurred by the Committee on Electricity, not yet audited	100.00
Total indebtedness	$425.54
Balance on hand as per Treasurer's report	192.24
Leaving a deficit of expenditures over receipts of	$233.30
There has been already collected by the Secretary for this year's memberships and dues	426.25

The Secretary also submits the following estimate of expenses for the coming year:

Secretary's salary	$100.00
Printing reports	250.00
Services stenographer	100.00
Stationery, postage, etc	50.00
Total	$500.00

It will be seen from these figures that the amount already collected from memberships and dues together with what will be obtained from the sale of reports and other collections will be barely sufficient for the expenditures of the Society for the coming year.

The deficit of $233.30 for the past year might be provided for by an increase in the amount of annual dues as suggested by a proposed amendment to the By-Laws already before the society, or it might be carried along as a floating indebtedness lapping over from year to year, trusting that with an increased membership and a reduction of expenditures the debt would finally be wiped out.

These two alternations the committee submit to the Society without recommendation.

L. W. RUNDLETT,
W. H. GLORE,
F. J. O'BRIEN,
Finance Committee.

Since writing the above report it has been suggested to the Committee that the expense of the certificates of membership might be canceled by charging each member of the Association one dollar for said certificate. These certificates have been gotten up in very excellent shape and are well worth this amount, and the Committee would recommend the adoption of the suggestion.

MR. RUNDLETT: Now, I want to say this, that, in looking over the list of expenditures, the Committee did not see that there has been any extravagance on the part of the Executive Committee. Our expenditures for the past year will be rather higher than for the year previous, and include the expense of the certificate of membership and things necessary in starting the organization, such as books, printing, etc. We all have listened with a great deal of interest to the paper submitted, and we all feel the value of these reports and statistics such as have been collected by the Committee on Electricity. They are certainly very valuable indeed. There has been considerable expense connected with these reports, such as postage and items of that kind. I know that one committee sent out several thousand letters to get the information which they carefully tabulated, and certainly while the members of the Committee have given so much of their own time and work this money that they have actually paid out of their pockets ought to be made up by the Society, and when we get our printed copies of these reports I think we will all feel that we are very glad that the Executive Committee has gone ahead with the work, and the same in regard to the other items. Of course the committee is desirous that we should cut the garment according to the cloth and hold our expenses down to the amount that we receive from dues and membership fees. I think after this we can run along all right. Seeing that our expenditures somewhat exceeded the funds that we had, I offered the resolution to increase our membership dues that it might be considered by the Association, but if we could obtain the price of the certificates, I am really inclined to think that we shall finally wipe out this indebtedness and that with a little effort in increasing our membership, we will be all right in the end. Still, I think this matter ought to be brought before the Convention, and discussed, as to how the necessary indebtedness can best be provided for, the incurring of which is approved by the Finance Committee.

In this connection the Committee also wants to submit the following resolution, which I will hand in at this time. Our Secretary, as we all know, does a great deal of work and spends a large amount of time in looking after the reports and carrying on the business of the Society, and he certainly ought to receive some remuneration, and I therefore offer this resolution:

"Resolved, That the compensation of the Secretary of the American Society of Municipal Improvements be fixed at $100 for the ensuing year."

THE PRESIDENT: You have heard this report. What is the recommendation of the Society? I understand the Committee makes no recommendation relative to the change of the Constitution in regard to dues.

MR. RUNDLETT: There is a resolution for the amendment of the Constitution before the Society which increases the annual dues. I myself am opposed to increasing the dues; I want to increase the membership rather than increase the dues. This shortage can be paid, of course, from the dues already collected for next year, but the amount already collected is only enough to carry on the expenditures of the next year, and so when we come around to the annual meeting there will still be a shortage, but if we can all take hold and increase our membership, it may be wiped out.

PRESIDENT HERRMANN: It may be if we are short at that time we can change the Constitution then.

MR. RUNDLETT: Yes, but I think it will be an excellent arrangement if each member will pay the additional amount of one dollar for this certificate of membership, which I am told by the Committee on Membership has been gotten up in such style that it might be framed and hung up as a souvenir. I think the amount secured in this way will be sufficient to wipe out that item of indebtedness.

MR. STAINSBY: I think the report of the Committee shows that a very careful examination of the accounts has been made and that the whole matter of running this Society has been very moderate. The pay of the Secretary, for instance, $100, seems to be a very small compensation for the amount of labor that he has devolved upon him, and I would second the motion, if it is a motion, that his compensation be $100 for the ensuing year.

PRESIDENT HERRMANN: Let us act on the report of the Committee first and then take up the resolution.

MR. STAINSBY: I want to say that I favor the payment of one dollar for this certificate of membership. If you increase the dues it may limit the number that come from the cities. For instance, we have eight delegates from the City of Newark alone here and another year they might not pay any more dues, and so with other places—they may not pay more dues than they are paying now, but send less members to the Convention. We want just as many people here as we can have and just as many cities represented, and I am in favor of charging for the certificate. I move that the report of the Finance Committee be received and approved and adopted by the meeting.

A MEMBER: I did not hear the report, but from the discussion that has taken place, it occurs to me that the method of assessing dues is not correct. It seems to me that, as all benefits that may come from this Municipal Congress come from proceedings, discussions, and from whatever other source that may come up here, the benefit goes to the whole municipality. We, as individuals, and as delegates, have no particular interest in this thing. We represent a community that will derive all the benefits that accrue to these congresses, and it seems to me, therefore, that the municipality, the city or town, ought to be a member of this Association and that they ought to pay the dues and that the dues ought to be large. We come from Parkersburg, five of us, at our own expense, and pay our own way. We are delegated to come here—our city is a member. Now, if there is a shortage in the treasury, and it is impossible to raise enough money from membership fees, there is no reason, it seems to me, that these cities should not pay ten dollars or twelve dollars, because it is worth twelve dollars a year to a city to get the information which has been brought out here. It seems to me a little harsh to have individuals who come here go down in their own pockets and pay individually, while, if they learn anything, it goes back to the benefit of their citizens. Some gentleman stated there were eight from his place, there are five from our place, perhaps one from some other, and the benefit goes to the cities in their individual capacity, not to the private persons individually.

PRESIDENT HERRMANN: I may say this question was considered very carefully last year. In addition to that, we cannot change our Constitution at this time. Under the Constitution it is provided that an amendment to it must be submitted at the first session of the Convention of each year.

MR. STAINSBY: In answer to the gentleman who has just taken his seat, I will state that the city of Newark is familiar with the fact that we are coming here at its expense, and are perfectly willing that we should charge such expense as is necessary in order to be a delegate to this Convention. I do not suppose that there are many of the members here who are paying their own expenses.

MR. PEARSON, Louisville: I am of the opinion this Society will do all of us a great amount of good.

I really am surprised for I had no idea that I should meet with a Society of as much importance, when I started from home. I think every city should be a member and send many delegates, and I for one propose to make this suggestion to my city's officials.

It is a fact that my city can derive a great deal of knowledge and be benefited more than I, for I may be its City Engineer only a short time, while it can attend any meeting as long as the society lasts and it is a member. Now, when I go back home I propose to explain the business of this Society to each member of our Council and Aldermen, and tell them all about it, and try to have them to interest themselves in it and aid in supporting it. I hope every gentleman present will do the same. From the papers and discussions, I have learned a great deal. I know I shall learn more at the next meeting and hope to be able to bring a large delegation to that meeting from my city, to be benefited as I have been at this.

Mr. Benzenberg: Mr. Pearson has furnished the very argument that brought about the section in the Constitution as it is to-day. The society can reach every individual member coming to the Convention, whereas it has no means of reaching a city as a municipality. The gentlemen who come here, however, are in immediate contact with their municipal governments and can lay before the councils with proper argument the benefits of this Association. This Association cannot go before the Councils and plead its cause; that must be done by these representatives, and it seems to me the only way to maintain this organization is by keeping the membership dues paid up. Let the members go to their Councils and show them the benefits derived and thus induce them to pay the expenses. You cannot have this Society deal directly with the Council, for they do not know us and we do not know them, but the medium between us are the delegates that represent them in this Convention.

President Herrmann: The question is upon the approval of the report of the Finance Committee.

A vote was taken and the report of the Finance Committee was adopted.

The resolution of the Finance Committee relative to salary of Secretary was then put to vote and carried.

Mr. Kennedy: There are one or two matters of business to which I would like to call your attention. At our morning session there was a motion offered by Alderman Saunders of Toronto as follows:

"Whereas, it is now the custom for municipalities to apply to one another for information in regard to works, practice, etc.

"Be It Resolved, That as the 'American Society of Municipal Improvements' has now become an established association, all such applications for information from others than members shall be referred to the Association for their action thereon, it not being desirable to impart information to those who are not in affiliation with the Association."

It was referred to the Executive Committee and they report as follows:

"The Executive Committee, to whom the foregoing resolution was referred, respectfully report that, inasmuch as the Association has no power to control the actions of the individual member with regard to imparting information, etc., the resolution should not be adopted."

On motion the report of the Executive Committee was adopted.

MR. KENNEDY: This Association is to meet in Nashville, next year. The Convention ordnarily meets on the second Wednesday of the month of October and it so happens that on the following day, the second Thursday, our Mayor and several municipal officers have to be elected by popular ballot, and that might interfere somewhat with our business. Therefore, I have a resolution that the date of holding the next meeting of the Society shall be fixed by the Executive Committee, but that such date shall not be more than thirty days from the date recognized in the Constitution.

The foregoing resolution was seconded and adopted.

MR. SHERRERD: Before we pass to the next order, I would like to ask Dr. Prendergast, who read Mr. Hill's paper, a question. He referred to the German Imperial Standard of hygiene, but he did not give any quantities that were allowed as a standard for purity of water supplies. I think it ought to be a matter of record in the proceedings as to what this German Imperial Standard is. I would like to ask if the secretary would get from Mr. Hill this information, or get it from somewhere so that it would be on the record. I think it is quite important to the water supply.

President Herrmann: I do not think Dr. Prendergast would be able to answer that question. Mr. Hill being a resident of Cincinnati, I will get that information and embody it in the record.

Mr. Hill answers this question as follows: "100 microbes per cubic centemeter."

Mr. Keating, Toronto: I happened to be in Hamburg last year and made it my business to visit the water works and was very kindly received by some of the officials. I might say it is not so easy in Germany to get access to the water works and the officials as it is on the American continent. However, I found that some of the engineers and bacteriologists, of whom I asked that question, considered one hundred colonies of bacteria per cubic centimeter as about the limit they would allow. The works are exceedingly interesting, and I might say that I consider the question a most important one to be brought before this Society. I also had the pleasure of visiting the works at Antwerp, which I think the most unique of the kind I have ever visited. The water is taken from a tidal stream, into which the sewage of Brussels is sometimes backed up. At the intake the water is drawn off into two large decanting reservoirs and from thence it is pumped up into revolving cylinders, where it is treated to what is known as the Anderson process, spongy iron being dropped through the water in the cylinders. It is then drawn off and passed over a series of cascades where trays are arranged with coke. The water is thus thoroughly aerated and passes into other reservoirs from whence it flows to the filtering basins and from there it passes to the pump wells and is then pumped to the city. Rather a complicated process as you will see, in fact it might almost be called a water manufactory, rather than a system of purification. However, I was assured that the water was very pure when delivered into the city mains. I made it a point to examine the water in the city, but cannot say that I was particularly struck by its appearance. It had a certain yellowish color, but I was told there was no harmful bacteria in it at all. There is one feature about the European supplies in which they have great advantages over us, and that is, that the amount of water consumed is absurdly small when compared with our consumption. I think in the City of Antwerp the consumption does not exceed something like fourteen or fifteen gallons a head. I do not know how that will sound to members of this Society, some of whom are accustomed to deal with supplies of 150 to 200 gallons a head per day. I might say that in the City of Manchester, before the new works were carried out, I understood the consumption was only about 12½ gallons per head per day. I think the question of limit of quantity such a very important one that I hope it will be considered by the members if they are not prepared to discuss it now.

Mr. G. F. Munro, Omaha, Neb., Chairman, then read the following report of the Committee on Taxation and Assessments:

To The American Society of Municipal Improvements:

Gentlemen:

Your Committee on Taxation and Assessment begs leave to report for your consideration upon that subject. The Chairman of the Committee expected to have a number of papers by members of the Society upon this important topic, and wrote several letters asking for the same, but unfortunately has received no replies. It was expected that this report would be upon the papers submitted and the recommendations made to cover such suggestions made as might be of value to the Convention. Being disappointed in not receiving papers upon the question of Taxation and Assessment, the Chairman of the Committee has prepared this report under difficulty, and has gathered together such information as was obtainable and with the indulgence of the Convention will offer the same for its consideration.

Your attention is first directed to a brief resumé of the important points in the systems of some of the important cities of the United States for the raising of a general revenue by taxation and for the assessment for benefit of local improvements.

The laws governing taxation and assessment in St. Louis are lengthy and very minute in detail. Briefly summarized they provide as follows for general revenue: A President of the Board of Assessors is elected by the people and an assessor for each assessment district is appointed by the Mayor and confirmed by the Council. The assessment in each district is made by the Assessor appointed for the district, under the supervision of the Board of Assessors, to whom reports are made. All property, real and personal, is included in the assessment. The President of the Board takes up the assessment roll, and gives notice by publication in the daily newspapers of the fact that the books are ready for inspection by property owners, at the same time setting forth the time for the sitting of the Board of Equalization, which shall remain in session daily for four weeks or longer, if necessity requires. This Board consists of the President of the Board of Assessors and four discreet and experienced real estate owners of the city, with a residence of not less than ten years, appointed by the Judges of the Circuit Court. The powers of this Board are very extended, authority being vested in it to raise or lower assessments and adjust irregularities and errors. When the Board of Equalization shall have adjudicated all matters brought to its attention, the Municipal Assembly makes the annual levy and collects the taxes. For municipal purposes a tax of one per centum is permitted, and to meet the valid indebtedness of the city only such per centum as may be required. This provision so far as limitations are concerned does not debar the Assembly from increasing the same from time to time as the improved conditions of the taxpayers will warrant, that the debt may be gradually decreased. On that portion of the city denominated "extended limits" the maximum permitted is four-tenths of one per centum for municipal purposes, and one-tenth of one per centum for the payment of the interest on the valid indebtedness as aforesaid. The sums realized from the collection of taxes for municipal purposes and for the payment of the public debt shall be kept separate and distinct. The collection of taxes are made by the Collector, who pays the same into the City Treasury daily.

The method of special assessments is elaborately provided for in the Charter, including plans for the necessary revenue for opening, widening, extending, grading, and otherwise improving streets, and for sewers and such other public improvements as are deemed necessary. For the appropriation of property for street purposes, three commissioners are appointed to determine the value of the land proposed to be taken, and apportion the assessment for damages and value of land among the property benefited, after having first determined the amount the city at large shall pay for any benfits it may have derived. For opening an alley the entire cost is paid by the abutting property. In the previous instance the awards made by the Commissioners are viewed and approved by the Circuit Court, the tribunal appointing said Commissioners. Both the property owners and the City have the right to except to the report as made and are entitled to hearing before the Court. The Court reports its findings to the Comproller and the Assembly takes steps to pay to the property owners respectively their proportion of awards. For the appropriation of land for other purposes than streets, the proceedings are the same.

The cost of construction of public improvements within the city is apportioned as follows: Grading of streeets and alleys, making of crosswalks, and repairs of streets and highways and cleaning of same and of all alleys and crosswalks are paid from the general revenue of the city, paving, curbing, guttering, sidewalks and the materials for roadways, repairs of alleys and sidewalks are paid by special tax against the abutting property, provided such special taxes do not in the aggregate amount to more than 25 per cent. of the assessed value of the property. Public sewers are paid from the general revenue and district sewers by assessment against the property in the district. In all cases where work of the forgoing character is paid by assessment tax bills in favor of the contractor are issued against each piece of property included in the assessment and stand as a lien against the same. They are collectable as other claims in a court of competent jurisdiction, with interest at the rate of 10 per cent. per annum after 30 days from demand for payment, and after six months at the rate of 15 per cent. Such certified tax bill is prima facie evidence that the work has been done, and of the liability of the owner of the land to pay the same. Right of resisting the collectioin of the tax bill is provided for, and a pleading may be made that the amount of work has not been done or its character may be attacked. In the event of the property owner tendering to the contractor the amount for such work as was actually done, and it is so determined, then judgment can be secured only for such amount. When the tax bills are paid they are recorded as satisfied by the Comptroller. and any bill not satisfied within two years, unless action in court has been commenced to collect same, the lien shall be destroyed and be of no effect against the land charged therewith. The city is not liable in any manner whatever, for or on account of any work done which is paid for in the manner indicated.

For sprinkling of streets the cost is also assessed against the abutting property and paid for in the same manner as heretofore stated for improvements.

The foregoing resumé is from the Charter of the City of St. Louis up to and including 1888, and my information is that while some minor changes may have been made the general system is still in operation in that city.

In the City of Milwaukee provision is made for a tax upon all assessable property, real and personal, for general purposes, a limitation being fixed for each fund for which a levy is made. The maximum levy for the General fund is six mills, Contingent fund 1-2 mill, Sewer fund 1 1-2 mills, Special Sewer fund 1 mill, Ward fund 6 mills, each, but may be extended to 10 mills under certain contingencies. School fund 3 1-2 mills. The levy for the General fund, payment of principal and interest on funded indebtedness, Public Library and Museum shall not exceed 14 mills in any one year. The levy is made by the Common Council.

The assessment of property, real and personal, is under the supervision of a Tax Commissioner, Ward Assessors being appointed for the purpose of listing property and fixing valuation. When completed the Mayor, City Clerk, Tax Commissioner and Ward Assessors assume the functions of a Board of Review, and after giving notice for a fixed time of their meeting, sit as a Board of Equalization. Property sold for taxes is not redeemable after a lapse of three years from date of sale.

Whenever deemed necessary to acquire land for the use of the city the proceedings are by condemnation, and the Board of Public Works is vested with full power in the premises, determining the damages and benefits, and what amount, if any, shall be paid from the ward fund, or whether the entire amount shall be assessed against the property benefited. The proceedings are subject to review and a property owner may appeal from the findings of the Board to the Circuit Court. Original local improving of streets, such as grading, guttering, graveling, macadamizing, paving, etc., is paid for by assessment against the abutting property, tax bills being issued upon a plan similar to that of St. Louis, while the street intersections, etc., are paid for out of the ward fund, as well as the future maintenance and keeping clean of the streets paved. Constructing docks in front of lots or parcels of ground along the rivers and canals and dredging of same is charged by special assessment to the property so fronting. Water pipes (main lines) are laid on streets and cost assessed against abutting property.

In the City of Denver the general assessment is made by the Assessor of the County of Arapahoe, and is reported to the City Council by the County Clerk when completed. The power of levying taxes for general purposes is vested in the City Council and shall not exceed in the total for all general purposes 10 mills on the dollar valuation upon the assessment as returned by the Assessor. This limitation does not apply, however, to the levy of taxes for the payment of the bonded indebtedness or interest on local improvements. In addition thereto a levy of one and one-half mills is authorized for the purchase of sites for public parks and the improving and beautifying the same. A nominal per cent. is allowed the county for making the assessment and collecting taxes.

The City Council has power to issue bonds for any and all local improvements, the provisions of the Charter being very broad and comprehensive in this particular. The cost of local improvements may be assessed in whole or in part against the property benefited, provision being made for nearly all character of public work in determining the method to be pursued. The cost of paving street intersections, excepting rare cases of triangular intersections, is included in the assessment against the district for paving the street. Storm water and district sewers are constructed at the cost of the property in the district, as are sidewalks, viaducts and tunnels. It is provided that the special assessment may be made payable in installments, when so desired by the owners of property. Failure to pay one installment in the prescribed time makes the entire assessment delinquent, unless said installment is paid before the sale of the property takes place.

With but few exceptions this system is identical with the one in use in the City of Omaha.

In the City of Boston the Council has power to levy and collect taxes for general revenue and for special improvements. The Council appoints Assessors to the number that it deems necessary and the assessment of property, real and personal, for general purposes is made in the usual manner. A limit of nine dollars on each $1,000 of valuation of property is provided for, and the levy cannot exceed that amount. Boston levies a poll tax also.

In payment for public improvements the usual plan of assessing by special tax the abutting property is carried out. In cases where damages exceed benefits, and the city is benefited by an improvement, a portion of the expense may be paid from the general revenue. Tax bills, which are a lien against the property, are issued in payment of the amount assessed against each parcel of ground and are payable in annual installments, bearing interest at the rate of four and one-half per cent. per annum.

The subject of special assessment is an interesting study to those concerned in municipal finance in this country. While that of general taxation is none the less so, it does not present so many or so varied features, and the general system in a majority of the states seems to be along the same line in application and operation. The tendency seems to be to secure for general taxation purposes the best system applicable in all sections and one that will result in an equitable and just assessment of valuation. We find that in most instances where changes are made in the general taxation and assessment laws that the model is that of a state where experience has taught the value of its law.

Investigation into the subject of special assessments develops that the question of benefit is the one recognized law of the system in the many states and cities. This in reality is about the only existing similarity of the various systems. Legislative enactments governing the levying of special assessments for local improvements are varied. Perhaps this may be due to the universal belief that local conditions demand local treatment, and that which might prove the opposite in another. A brief inquiry into the history of this question in the United States would appear to be appropriate at this time.

The system of special assessment traces its origin back to the period of Colonial New York. It first developed as a revenue system in the province of New York and has maintained its place on the statute books from the time of its inauguration. As early as 1691 an act was passed by the New York Assembly providing for the improvement and maintenance of streets, alleys, etc., a Board being created for the purpose of levying an assessment against abutting property to meet the necessary expense. Subsequent acts enlarged the powers of the city along these lines, and in 1813 extended the same to the principal cities of the Empire State. In 1840 it was provided that no levy exceeding one-half of the assessed value of the property should be made. An act of 1852 established the permanent grades of the streets and required that any further changes could only be had upon the petition of two-thirds of the abutting property. Beginning with 1876 a series of acts extended the time for the payment of pending assessments, and provided for future payment by installments at a fixed rate of interest. During the period various laws were enacted to protect the property from unjust and unfair assessment and to guard against fraud and collusion. There are at present two distinct systems in vogue. The opening, widening, etc., of streets, invoking the taking of private property, is undertaken, with certain formalities of a legal nature, before the courts, thus coming within the jurisdiction of the law department and board of street openings. In the other cases—building, wells, paving and repairing streets, constructtion of sewers, etc.—the assessment for bene[illegible] is made by the Board of Assessors and Board of Revision and Correction. In explanation of the assessment let us take the system of street improvements. The work is carried out by the proper department and at its completion the cost thereof is certified to the Board of Assessors. This Board consists of four disinterested persons, selected by the Commissioners of Taxes and Assessments. Upon receipt of the certificate of cost they transmit the same to the Comptroller for an indorsement of the interest chargeable upon such advances as the city may have made during the progress of the work. When thus returned the Board proceeds to assess the amount expended upon the property owners to whom the special benefits of the improvement are to accrue. The Board determines the area of the district and the extent of the benefits, unless a permanent area has been established as in Sewer Districts. The charge is made according to the individual benefit, subject to two limitations, namely, that it does not exceed the benefit and that it is no greater than one-half the assessed value of he property. Upon completion of the assessment roll 10 days' notice by publication is given and the property owners are allowed 30 days in which to present objections in writing. The Board may then alter or modify the assessment list. If objections still remain the roll is sent to the Board of Revision and Correction. This Board consists of the Comptroller, Recorder and Corporation Counsel. They confirm the assessment or return the list for further correction and revision. Assessments for street openings are somewhat different. Proceedings for the opening of new steeets are instituted by the Board of Street Openings and Improvements. Three Commissioners constitute this Board and are appointed by the Supreme Court, from two lists of names submitted by the property owners and the city. The Commissioners are allowed four months for the performance of their duties. After viewing the premises to be taken, and hearing interested parties, a report upon damages sustained and benefits accrued is made up. The damages and benefits are separately determined and all expenses are assessed upon the property owners in the way of benefits, unless provision has previously been made for a specific portion of the cost to be met by the corporation. Before reporting to the Court notice is given by publication for thirty days of the intention of the Board to report at a certain time, and that it will hear within the 10 days next succeeding the 30 days after the publication any objection thereto in writing. After making corrections or alterations the assessment is reported to the Court. If interested persons then still object to items aggregating more than one-half of the total, all further proceedings may be discontinued if such persons so desire. Otherwise, after considering the complaints made, the Court either affirms or remands the report to the Commissioners for correction.

In New York assessments for benefit become both alien against the property and a personal liability of the owners. If unpaid after 60 days interest at the rate of 7 per cent. per annum is charged. Assessments for certain improvements are payable in installments each of five per cent. of the total amount charged, with 7 per cent. interest upon the sums still unpaid. Whenever an assessment is unpaid for three years the Clerk of Arrears proceeds to collect the same by public sale of the property.

While the New York system may in a measure be called typical, yet other cities are not supplied with a duplicate procedure. Baltimore, Boston, Cleveland and Washington have but one set of assessment officials. The power to initiate proceedings for special assessments may be concentrated in the Common Council, as in Chicago, Cleveland, New Orleans, Omaha, Philadelphia, San Francisco and Washington, or in the executive departments, as in New York, Boston or Jersey City, usually the Department of Public Works. The general purposes to which are applied the system of special assessment are the construction and improvement of streets. However, the system is applied to other uses. Chicago, Philadelphia and St. Louis may levy the expense of laying water pipes against the abutting property; Chicago levies the cost of erecting lamp posts; Cleveland, Minneapolis, Omaha and St. Louis may impose special assessments for street sprinkling, and so on through the list of cities and purposes for which levies may be made.

We find many safeguards thrown about property owners to prevent hasty or unjust taxation for special purposes. Yet in Boston, Chicago, New Orleans, Philadelphia and Washington, the wishes of parties interested need not necessarily be consulted, no petition for action being required. On the other hand a petition is necessary in Baltimore, Denver, Cleveland, and Omaha, or a remonstrance must be heeded. The usual method is pursued of giving notice of an intended improvement, or of giving a hearing to property owners when it is proposed to levy the special assessment. In St. Louis the Board of Public Works hears remonstrances, in Cleveland a special Board of Equalization, in Omaha the Common Council, in Chicago three members of the Council or other competent persons, and three Commissioners appointed by the Court to apportion the assessment. In Washington, however, a property owner may not hear of a special assessment until presented with a tax bill, and this is true in Philadelphia for sewer and water pipes. In Washington, New Orleans, Boston, the property assessed must abut upon the line of work, while in many other cities districts are created, property being included that may be determined as benefited. In some cities limits are fixed for the amount of the assessment per front foot, applying more particularly to sewer and water pipes. In all cases the assessments are made a lien upon the property and in some cities becomes a personal liability of the owners. Various methods are adopted for the collection of the assessments, the general rule being that applied in the collection of general taxes.

The recognized rules of special assessment for benefit are universality, equality and uniformity. By these is the justice of public impositions usually determined, and most frequently the objections to special assessments are alleged inequality and lack of uniformity. Such charges for benefit are not universal, as they do not attach to all subjects within the State, or even to all those within the political jurisdiction imposing them. If they did the difference from ordinary local taxes would be slight. They do possess the quality of universality within the district specially created. All become subject to the imposition whose circumstances place them within the rules laid down for liability. There are neither exemptions nor exceptions among those who would otherwise be included within this exercise of the taxing power. Within the district of apportionment the demands of the rule of universality are fully met.

Complaints of inequality and lack of uniformity arise likewise from a similar view. Only to those who have in mind some ideal system of taxation does special assessment for benefit appear to operate unequally. If we accept the standard of individual property, income and expenditure special assessments are certainly defective. But is it proper or scientific to test one system by the forms applied to a totally different system? The only method by which the equality or inequality of any public contribution can be determined is by asking whether it operates alike upon one and all who are found in the same relative position. The natural inquiry here then is whether one owner receiving a certain benefit from an improvement is subject to a burden equal to that imposed upon every other owner deriving a similar benefit. The theory of special assessment makes every one subject to taxation in proportion to the benefits derived. In this there is nothing unjust by reason of inequality or lack of uniformity.

The very idea of special assessment precludes the soundness of all objections on the ground that the apportionment departs from the ratio of ability to pay, unless it be contended that no public burden not imposed according to the ability of the contributor to pay, can ever be regarded as just. Whatever be taken as the evidence of ability to pay special assessments for benefit will be seen to be unpardonable sinners against the rule adopted. They are not levied in the ratio of the value of the property, for it frequently occurs that a worthless strip is increased in value to a greater extent than a valuable one. Neither do they conform to the variations of income, for an owner who derives no income from his property may be sunbject to as heavy an assessment as another who receives in rentals from a tenant a fair return each month. Nor do they bear relation to the expenditures of the assessed, for the present purposes to which property is devoted are immaterial to the Assessor. If there be any injustice in a special assessment it must lie in this: Where an expenses is to be incurred by a local authority which results in special distinct and measurable advantages to the property of particular individuals, it is more equitable that those who benefit thereby should contribute to the expense to the extent of those benefits than that the burden should be placed upon others who have received no such special benefits.

Touchng upon the subject of taxation for general revenue the Committee is not prepared to make an extended or vigorous recommendation. There are in the country many systems that have much to commend them, but as it seems each State has followed its own inclination in the matter, and adopted that which its legislators deemed best for the community concerned, and as they are so divergent in general application and detail, we would not care to offer much upon this subject without opportunity for further investigation. However, we believe, that a Board of responsible and experienced men on taxation and assessment, completely removed from political influence and entanglements, should have entire control of assessing property. Whether it should be a state or local board for each county, we believe should be left to the discretion of the members of the various Legislatures to determine. In this regard we desire to say that Ohio has a very excellent system and some of the members of the Society from that State, who are more familiar with its workings in detail, than the Committee, can undoubtedly give us much valuable information upon the subject.

As the assessment of property for general revenue comes more porperly within the jurisdiction of the State, and in most instances is under the control of the county officials, it does not so deeply concern this organization as does that of special assessment for benefit, with which we are more intimately connected in our official capacities and in the discharge of our official duties. Your Committee has given this question much thought and consideration, and regrets its inability to present a more exhaustive review of the systems in operation in the many cities of the United States. In its recommendation the Committee desires to direct the attention of the Convention to his fact. That while it is possible to inaugurate systems nearly identical in all cities, it is necessary that in equalizing assessments for benefit much latitude be given the assessing power, that existing conditions may be fully taken into consideration and as equal a distribution of the imposition of taxes for benefit be made as possible. The general proposition of assessment for benefit is to secure the construction of local improvements at as low a cost as possible to the property owner, the work to be first-class in character, and to place upon the individual property only such taxes as seem just and equitable. How to reach this conclusion is a subject that has been more generally discussed perhaps than any other question of taxation. Volumes have been written upon it, and its consideration has occupied the attention of law makers for hundreds of years. There are those with whom it has been a life study and we find the most learned authorities at variance as to the best methods to be applied. Without it the improvement of our thoroughfares and the public grounds would be an impossibility. It is a necessary part of our municipal organization and as such is entitled to the greatest consideration and to the best of thought by those associated with the government of our cities.

The application of a system for an assessment of the cost of paving a street could hardly be made identical with one to meet the expense of constructing a sewer. No more could the latter system be made applicable to one involving the appropriation of private property for the opening of a new street, or the widening or extending of another. Thus it must be apparent at once that each branch of a local improvement must have a system of special assessment so constructed as to be entirely just and equitable and at the same time conform to the conditions surrounding that of each character. While the underlying principal may be identical, the .detail of each is necessarily different. Therefore your Committee would direct the attention of the Convention to what we deem the best system of assessment for benefit where a street is improved by paving or repaving.

Before a street is thus improved, we believe the greatest publicity for the purpose of informing the property owners should be adopted. For instance, after the plans, specifications and approximate cost, if not the actual cost, with all details have been settled by the city they should be given at least 20 days' notice in the public press, as well as written personal notice, to all the owners of property that the same is on exhibition for their examination and any suggestions or complaints they wish to make; that at least 10 days after the expiration of notice, should be given for the consideration of all protests and suggestions of property owners for changes, or the correction of errors,, or the abandonment of the work; and in case of city officials and property owners to agree the same should be finally submitted to a court designated for that purpose, to be corrected, confirmed or rejected within a given time. If confirmed, during the progress of the construction of the work, property owners should be invited to file complaints if work is not being done according to contract, and if well founded, city officials should have the same immediately corrected. If so corrected, and the work finally done, the property owner should be barred from protest or maintaining an action in court against the payment of the assessment on account of any omission, error or mistake of a technical or legal nature for any cause other than actual fraud and corruption. With this step in the proceedings comes the question of what is the best system for the pro rata assessment. So important is this matter that the Committee feels that local conditions should govern, taking into consideration, of course, that the paramount rule to apply is what benefit has been conferred by the improvement. With the assessment made along the lines indicated, the next inquiry, and an important one, is how are the assessments to be paid, as a whole or in yearly installments at a fair rate of interest annually on the unpaid portion. We are convinced that the best method is the issuance of short time bonds to pay the cost of improvement, that the contractor may receive cash, and the benefit of lower prices thereby accrue to the property owner. The short time bonds should run from one to ten years, be in small denominations, and bear the lowest rate of interest they can be successfully floated at. These bonds should mature as the installments of the assessment fall due and are paid that they may be taken up and the obligation canceled. This method renders less burdensome the imposition of the taxpayer, as we find that cities pursuing this course, paying the contractor in cash, are able to secure more active completion and better propositions at less money than those that follow other plans. In many cities the cost of intersection paving is included in the assessment against the property within the district, while in others the intersections are paid for from the general revenue. The latter method we feel is the most just to all. With the addition of such details as conditions demand we believe the foregoing is a fair and impartial proposition for the assessment of the cost of paving or repaving.

For a system to cover the cost of construction of sanitary and storm water sewers, we are convinced that the creation into districts of such property as will be benefited is proper and just. Drainage, or main sewers, should be paid for by the city. The system to apply for assessment, with all conditions duly considered and properly adjusted, should be nearly identical with the one proposed for paving.

Where cities and towns operate their own systems of water works, it would seem that the laying of pipes in streets should be at the joint expense of the property benefited and the city at large. Whether this assessment should be met in one or more installments, the Committee is hardly prepared to advise. This problem would be one for the assessing board to solve, taking into consideration the amount of the assessment and the ability of the property owner to meet it in one payment.

As curbing is a recognized part of the improvement by paving, we feel that the rules governing the payment for paving should apply in the case of curbing.

When it comes to the recommendation of a plan to meet the cost of appropriating private property for the use of the public, the Committee hesitates. So many features are presented in these cases that it is nearly impossible to make one analogous to another. In one instance the benefit may accrue almost wholly to the city at large and the immediate property may not profit thereby. On the other hand the benefit may be to the abutting property alone. In any event the determination of what the benefits may be, should be left to the discretion of the assessing authority.

For the purpose of determining the benefit of the various improvements and the levying of the assessment to pay the same, should be in the hands of an independent and competent board of assessors, two or more in number. This Board should thoroughly investigate all proposed assessments and give the property owners ample time to inform themselves and present such objections to the same as they deem equitable. All proposed assessments should be given publicity before any expense be incurred on any improvement, and if the cost of the work be less than the approximate estimate the final assessment should be reduced that amount. But each property owner should know in advance the obligation assumed in having the work proceed, and each protest should receive due consideration and fair treatment.

Respectfully submitted,
GEO. F. MUNRO,
Omaha, Neb.
Committee on Taxation and Assessment.

The following report of the Committee on City Government and Legislation was read by C. C. Brown, Omaha, Neb., Chairman:

REPORT OF COMMITTEE ON CITY GOVERNMENT.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS:

The scope covered by the title of this Committee is so great that it is impossible for any large part of it to be covered by any report or any number of papers at a single meeting of the Society. The members of the Committee being all connected with their respective Departments of Public Works, the ground to be covered by this report will be limited to that of problems connected with the inception and construction of public improvements usually instrusted to that branch of the city government. As the items in this field are numberless, the report will concern itself principally with the general principles upon which the business is transacted, and where details are entered into they will be those in relation to the smaller problems, which are, nevertheless, the most troublesome in actual practice. In general the examples taken and the conclusions reached will be with special reference to the class of cities whose average population lies between 100,000 and 200,000, some reference being made also to the conditions in small cities and on the other hand in cities of a half million or more population. Other committees must take up the details of the work outlined in this chapter of the book on city government to be prepared by the successive committees of this Society, and still others the various other departments of city government.

A. With reference to the method of selection of the heads of Departments of Public Works and their tenure of office.

1. One principle upon which the selection of heads of departments is based is that making the Mayor the responsible head of the city government. Under the action of this principle the only elective officers are the Mayor and City Council, all other officers being selected by the

Mayor without confirmation by the City Council, to act during his pleasure. The city adopting the nearest approach to this system is the City of Indianapolis, which also elects the Police Judge and the City Clerk, who is actually little more than the secretary of the Council and the clerk of the Police Court. The County Treasurer is City Treasurer *ex-officio*. The Mayor being held responsible for the proper conduct of all public business, the failure of himself or of any of his Boards to satisfy the public insures a change of administration at the end of his term. When the new Mayor takes his office, no matter if he is of the same political party as his predecessor, the chances are in favor of an entire change in the heads of departments, as each Mayor must have men who are fully in sympathy with himself, and usually men who helped to make the last administration unpopular are not considered the most available men for the new government. The consequence is a lot of new men, who must spend some time, make some mistakes and waste some money, before they become sufficiently acquainted with the history of their departments even if they are fully qualified in every other way. If the term of office of the Mayor is short, (two years in Indianapolis) the changes are too frequent to enable a Board to become fully acquainted with its duties before it is superseded by another, and if the Mayor decides that a Board is not doing satisfactory work, more frequent changes are made. In some departments these frequent changes are not very serious, but in the department of public works there is unquestionably much waste of time and money, in addition to the disadvantages arising from the practical impossibility of fixing upon definite system for the prosecution of public work. If the term of office of the Mayor were longer, there would be less objection to the system on this particular account, and if he were ineligible to immediate reëlection some other advantages would appear. The government of any city of the size under consideration is greater than any one man can master fully in two years, and it is unjust to the ordinary candidate for Mayor to so heavily overload him as this system requires.

2. Another system, which divides the responsibility somewhat, is that by which the Mayor appoints the heads of departments subject to confirmation by the Council. If the appointments are for his term of office, the system is not materially different from the first mentioned, except so far as the necessity of confirmation by Council is a check on the character of appointments, and in some cases gives an opportunity for shirking responsibility. This system is quite common among smaller cities.

3. A third system, more general than any other, probably, is that by which the Mayor appoints the heads of departments, subject to confirmation by the Council, for definite periods of time. The theory of

this method is that there must be continuity in the administration of the details of public business and full knowledge by the Boards of the systems of public works as laid out from time to time, which can only be fully assured by continuing the majority of each Board in office at each stated period of change. The method is evidently directly opposed to the method which makes the Mayor the city government. While, theoretically, it does not concentrate the responsibility so definitely upon a single person, practically the result is not far different so far as fixing the responsibility is concerned, for the general tendency is to attribute to the respective Boards their errors, rather than to the Mayor. Under the first method the penalty for the sins of one department is visited upon the entire administration when election time comes round, notwithstanding the good work of the others. The third system does not give the voters quite so direct control over the tenure of office of the various Boards. This is a great advantage to the economical conduct of public works under a definite and stable policy.

Milwaukee has adopted this system. Its Board of Public Works consists of four members with three years' tenure of office, the City Engineer being president of the Board and the terms of office of the other three members expiring one each year. The city is divided into three districts, and one member must be appointed from each of these districts. The appointments are confirmed by the Council. It has always been the intention of the Mayor to appoint a practical builder, or one conversant with public works, or generally some one who has for years had experience as superintendent of public works, or some special class of work, and the present Board consists of (1) a former city engineer, (2) a former assistant engineer in charge of one of the divisions, (3) a former inspector and superintendent of public buildings and foreman in the department of the Board, and (4) the City Engineer as ex-officio President.

In St. Louis the Mayor and the President of the Board of Public Improvements are elected for terms of four years. The four additional members of the Board are appointed for terms of four years at the beginning of the third year of the Mayor's term. The appointments are confirmed by the Council. Council can remove, in which case the Mayor can appoint a successor without confirmation. The Mayor can remove, in which case the Council fills the vacancy.

Omaha has three members of the Board of Public Works, one appointed each year in July and confirmed by the Council. The Mayor's term of office is two years and begins in January.

In Cleveland the Mayor appoints the Director of Public Works, who is resopnsible for the administration of affairs pertaining to all sewers, paving, street cleaning, bridges, water works, lighting, public buildings, street repairs, etc. The Director appoints the necessary engineers, clerks, foremen and laborers, bridge tenders, etc. His term of office is two years.

Many other examples might be given which would be modifications in some degree of these typical cases.

With regard to Boards of Police Commissioners there was a period when it was popular to refer the appointment of members of these Boards to the Governor or to a Board of State Officers, that the appointments might be as far from local politics as possible. Some such laws are still in existence, though some have been repealed for forms more nearly approaching local responsibility.

4. In many of the smaller cities the men doing the city's work are elected by the Council or in part by the Council and part by the people, the full control and direction of the work being in the hands of the Council and its Committees. We will leave the discussion of the numerous objections to this system and its few advantages to our successors.

Scarcely any two cities, unless small enough to come under a general charter, such as is provided in many Western States, have the same form of government, and there are many permutations and combinations of the above general classes, but the principles (1) of individual responsibility of the Mayor for the entire city government, (2) Council control, (3) continuity of management of city work, or (4) the Jacksonian principle, "to the victors belong the spoils," are the element underlying them.

B. With reference to the composition of the Board of Public Works and the division of the work a few examples will be given.

In Indianapolis the three members of the Board are business men who hold regular meetings as a Board and decide upon all matters brought before them and upon the policy they will pursue in laying out public work to be undertaken. There is no requirement of technical skill nor do they usually spend all their time in the work. The City Engineer is an appointee of the Mayor but is the servant of the Board. The public work was formerly done by several departments with heads appointed by the Council and practically the same departments are still continued, with such modifications as are imperatively demanded from time to time, the only difference being that the three members of the Board of Public Works take the place of the fifteen or more members of the Council. The short tenure of office of the Boards and of all sub-officials, has so far prevented a proper systematizing of the work, and each head of a department works under the same advantages and disadvantages as in the old Council days except that the Department of Public Works is not so many headed and the personal character of the members is usually higher than that of the councilmen. The Board is independent of the Council in the appointment of employes and in the inception and construction of public works. The first Board under the new charter was in office about three years and was a well constructed Board, consisting of a business man as president, a civil engineer and an architect. The city was far behind in its public improvements, and the Board laid out a comprehensive system of improvements, especially in sewers and street paving, and had time before the inevitable catastrophe to put the sewer system especially in such shape that the only possible thing was to go on with it. The successive new Boards since, have begun their terms with the intention of reducing the amount of work under way, but until the present date have been unable to cut off any of the work planned by the first Board without falling into worse evils than were promised by the voters, who regularly every two years overthrow the administration because it is taxing the people too heavily for public improvements. The work is now so well in hand that the present administration has better prospects in this regard of being its own successor than any of its predecessors. Now that the absolutely necessary work, so well planned by the first Board, is completed, the natural consequences of the lack of system, extending from the appointment of the Board to the appointment of street laborers, will have more opportunity to show themselves. The admirable system of carrying out public improvements, sewers, pavements, sidewalks, prescribed in the charter, and the high character of the men composing the various Boards and the comprehensive system adopted and fortunately fixed upon the city by the first Board, have made the system more successful than it deserves. A like system was adopted a short time ago in Fort Wayne, Indiana, and its development is awaited with interest, as some of the controlling factors in the Indianapolis situation are not so strong in Fort Wayne.

In St. Louis, each member of the Board, except the President, has charge of a special department of the public work, water, sewer, street, harbor and wharf, and park, and is in full charge of the expenditure of money when once appropriated for his use. Plans must be approved by the Board as a whole and also by the Council, which has power to reject but not to modify. The Board as a whole lets contracts for work, which are submitted to the Council for approval, but the head of the department has full charge thereafter. There is no requirement that the appointed members shall be engineers or experts in their respective lines, and a change to this effect is to be desired. The departments are also not quite as well distributed as might be, and three members in addition to the President could readily take care of the work. Experience has shown that in some regards the system is unwieldy for so large a city as St. Louis.

In Milwaukee the Board divides its work at its pleasure. At present the City Engineer, in addition to his general duties as President, takes special charge of the maintenance and construction of the water works and the operation of the various other pumping stations, such as the flushing pumping works and the sewage pumping works. One member of the Board has charge of the construction and maintenance of docks and bridges and of dredging; one has charge of the construction and maintenance of sewers; and one has charge of the construction of school and other public buildings. Each of the district members has charge also of all street work in his district. Each member is responsible to the Board as a whole for the efficient management of his work. The system works well. The city engineer prepares plans and specifications for all classes of public work excepting public buildings, and as Presiden of the Board is concerned in the formulation of the plans for work prepared each year by the Board. He is not required to sign contracts let by the Board.

In Omaha the President has general charge of all work with advisory power in all departments, one member is street commissioner in charge of construction and repair of streets, and one member is sewer commissioner in charge of sewer construction, repairs and cleaning. The two latter have personal charge of all work in their respective departments, all expenditures, and employment and discharge of men being subject to review by the Board as a whole. The Board does not have the power to originate improvements, but prepares contracts for work ordered by the Council for its approval and takes charge of construction. There is no statement of qualifications for membership. The City Engineer prepares plans and specifications for all work, subject to the approval of the Board and has charge of the laying out of the same on the ground. He does not have control of inspection of public work but the Board's inspectors report to him and he must certify that the work is completed according to contract.

In New Haven the Board of Public Works consists of seven members, including the Mayor as ex-officio chairman, one of its members being president. The term of office is three years, two retiring each year. The Board has control of all expenditures of money appropriated by the Council and apparently acts as a whole. The City work is divided into departments with different heads, sewers, streets, parks, city engineer, etc., which seem to be in a measure independent of each other except through the Board.

The cities of Indiana working under the general charter for cities have a Board of Public Improvements which is a Committee of the Common Council, and has the powers of such committees with some additonal powers in case of small expenditures or of emergency as they may be granted by Council or assumed by the Board. The City Engineer is in effect an advisory member of this Committee if he is competent to act as such, otherwise he is the servant of the Committee.

Cleveland has a Board of Control, consisting of the Mayor, the Director of Law, the Director of Public Works, the Director of Police, the Director of Fire, the Director of Accounts, and the Director of Charities and Correction. This Board is the executive branch of the city administration. The Council only appropriates and authorizes the expenditure of money. Improvements are recommended by the Board of Control, and if satisfactory to the Council, ordinances are passed and resolutions adopted, authorizng the different directors or the Mayor to carry out the provisions of ordinances, resolutions, contracts, etc., pertaining to their respective departments. There is a Board of Park Commissioners independent of the Board of Control and Council. The Mayor and President of the Council are members of this Board. The term of this Board will expire after the park system is developed and then the care and management of the parks will be turned over to the Director of Public Works.

Nearly as many variations of the above as there are cities might be given, and there are doubtless some systems materially different from the above which have not been brought to our attention at this time.

C. As to the inception and conduct of public work, perhaps examples will again be a convenient form of presentation.

As regards Sewers the general sentiment is that the ordinary property owner is not a competent judge of the necessity of this class of improvments, and therefore the establishment of sewer systems and construction of the same is very generally taken entirely out of his hands, and if the Board of Public Works or City Council or other supreme authority considers the work a necessity, it is carried through without reference to his remonstrances.

In Indianapolis the Board of Public Works is the Supreme authority and there is no appeal from their final decision after remonstrators are heard, unless actual fraud could be proved. The entire cost is assessed against the property benefited.

In St. Louis the Board of Public Works prepares the ordinances which are adopted or rejected by the Council, that body having no power of amendment of ordinances presented by the Board of Public Works.

In Milwaukee the Board of Public Works, after consultation with the aldermen of the various wards, lays out a scheme of improvements for the ensuing year and presents it to the Council. When a scheme mutually satisfactory to Board and Council has been found, the work is constructed by the Board as nearly as possible on the determined lines. In case of sewers, the work must be done upon lines laid down in sewer diagrams or plans for each entire district drained by a main sewer, which diagrams have been adopted by the Board of Public Works after notices to property owners of the preparation of the same, and consideration of modifications proposed in interested parties. The cost is assessed on the property per foot front if the cost of the sewer is less than $1.60 a lineal foot. The city pays for all street intersections, for catch basins and for all over $1.60 a lineal foot.

In Omaha the City Council has the power to lay out sewer districts and order the construction of sewers therein, the plans and specifications being prepared by the City Engineer and Board of Public Works, the contract let by the Board with the approval of the Council, and the construction supervised by the Sewer Commissioner with the President of the Board. The cost may be assessed on the property benefited but the city usually pays a portion on main sewers.

In the Indiaina cities the same procedure is gone through with, except that the Council has charge of the whole matter and may entirely ignore any engineering assistance.

In villages of New York the first step is the appointment of a Board of five Sewer Commissioners by the village trustees, holding office so that the term of one expires each year. This Board prepares a plan for the sewerage of the village, which must be approved by the State Board of Health, and must, under the regulations of that Board, be complete and in full detail. If all or a part of the system is to be constructed at the charge of the village at large, an electnon must be held and a majority vote for the resolution is required. The resolution provides the proportion to be assessed against the village, and the proportion against property directly benefited. Any sewer not provided for in such resolutions can be constructed on petition of owners of 500 feet of property along the line of such sewer, the cost to be assessed on the property benefited.

In Cleveland the Board of Control and Council jointly determine the necessity of a sewer in any street upon the recommendation of the Chief Engineer and Director of Public Works, and build sewers independently of property owners. Two dollars a front foot is the highest that can be assessed on abutting property. If the sewer costs more than this amount, the balance is paid by the sewer district. There are 17 sewer districts in the city. Before a sewer can be built, the necessity of the sewer must be advertised and the people interested notified that plans may be seen and discussed at the Board of Control at a certain time. If it can be shown that a sewer is not needed or can be postponed, the Board usually makes a recommendation in accordance with the wish of the majority of property owners who will be taxed for it.

As regards Paving the methods of procedure are more varied than in the case of sewers.

In Indianapolis the Board of Public Works has the same authority in commencing proceedings as in the case of sewers, and prepares plans, specifications and resolutions ordering the paving. After the Board has heard remonstrators and has taken final action adopting the resolution, property owners resident on the line of the improvement have ten days in which to file a remonstrance against the improvement. If properly signed by a majority of such resident property owners, the resolution may be dropped by the Board or may be sent to the City Council. In case the resolution is passed by the Council by a two-thirds vote, the improvement is made under contracts let by the Board. This decision on appeal is the only function of the Council with reference to public improvements. The entire cost of the improvement is assessed upon the abutting property, one-half the cost of street intersections being assessed one block each way on the intersecting street. Repaving may be done under the same method of procedure. Repairs are paid for from city funds, and the Board can decide upon repaving at its pleasure. There is no special provision for grading as little is necessary.

In Milwaukee the first step is the establishment of the grade, which is done by ordinance of the Council. Cost of grading and regrading if grade is changed, is assessed to the property benefited, the city paying for intersections. The city pays repairs and maintenance of graded streets out of the fund raised in the ward in which the street is located. When it is desired to change an established grade assessments of damages and benefits must be made, the excess of damages, if any, and the excess of cost in front of any lot above benefits to be paid out of the ward fund. Petitioners are not entitled to damages. The vote on the ordinance must have all the members in the ward or wards interested and two-thirds of the members of the Council in its favor. The intention is to make changes of established grades as difficult as possible. When paving is desired it is determined upon by the Board of Public Works in conjunction with the aldermen of the ward and approved by the Council. The first cost is assessed upon the property in the manner described for grading. Any repairs, maintenance and future repaving must be paid for out of ward funds. The effect of this provision has been to make the property owners work for the cheapest pavement possible to obtain, that the burden of maintenance and repaving may be thrown off their shoulders with as little expenses as possible, and accounts for the poor class of pavements laid in Milwaukee heretofore. By a new law passed in 1893, new pavements on concrete foundation are paid for by the property owners if the cost of the old pavement and the new pavement replacing it are together not more than three dollars a square yard for the area to the middle of the street in front of the property. The Board may construct new pavements in the absence of petition if its recommendations are approved by the Council after reference to and favorable report from a special committee of five Aldermen, none of whom are residents of the ward in which the improvement is proposed.

In St. Louis the Board of Public Improvements prepares all ordinances for street improvements, with or without petition. If legal remonstrance is made, as provided, the Board may still proceed by unanimous vote. The ordinance must be passed by the Council, and if remonstrance has been made, must pass by a two-thirds vote. There is a general provision that special taxes shall not amount to more than 25 per cent. of the assessed value of the property to a depth of 150 feet, any excess to be paid by the city.

In Omaha the first step is an ordinance by Council establishing the grade. An ordinance is then passed declaring the necessity of grading, and under this ordinance assessments of benefits and damages are made by a commission. If the city pays half the cost of grading, the work can be done without petition. If there is a petition of owners of three-fifths of the property frontage, the entire amount is paid by the property. At any time after the report of appraisers is filed, an ordinance may be passed levying the amount of damages upon the abutting property. An ordinance is passed ordering the grading. The Board of Public Works then lets the contract for the work on advertisment, the contract being approved by the Council. After completion, the cost of grading is levied on the property by ordinance. All such tax levies are prepared by the City Engineer on certificate of amount from the city Controller, and are subject to revision by the Council, sitting as a Board of Equalization. If it is desired to change an established grade, a petition from owners of a majority of the frontage must be presented. After passage of the ordinance ordering the change of grade, the procedure is as above. An ordinance can be passed creating a street improvement district, but a petition from owners of a majority of the frontage is necessary before an ordinance can be passed ordering the paving. Thirty days is given property owners to decide upon the material to be used. An ordinance is then passed ordering the paving with the material selected by the property owners or by the Council in case property owners fail to express a preference. The cost is assessed on the property, the city paying for street intersections unless there is a three-fifths petition of the property, in which case the city is relieved of expense. Street railways must pave at the same time and with the same material unless waived by property owners to secure street car line extension. Repairs, if made under a contract for a term of years at a fixed price per year may be paid by levy of tax on property in paving district, but is actually paid by the city.

In Cleveland, pavements are laid irrespective of the residents, provided the Board of Control and Council recommend them, but both bodies must agree in regard to the improvement and determine the kind of pavement and the time to be allowed for paying for the same. When a street is repaved, the abutting property is assessed for one-half of the cost, only, and the other half is paid from the general fund. Pavements are guaranteed from five to ten years. Several gangs of pavers are employed to repair bad places as they develop, thereby prolonging the life of a pavement. The extensive use of the bicycle makes increased demand for pavements free from depressions and imperfections.

As regards Sidewalks the general sentiment is that they are specially under the care of the abutting property owner and although the city is usually given practically the same control of them as of pavements, they are allowed to fall into the hands of the property owner and are a constant source of trouble, as a consequence. In Indianapolis they are treated in every way the same as street pavements, the Board deciding what material shall be put down, how, and when, subject to the same remonstrance as in street paving.

In Milwaukee the construction, repair and cleaning and removal of snow from sidewalks is chargeable to the abutting property and may be done by the Board whenever and in whatever manner considered best by them, except that property owners have twenty-four hours in which to remove snow.

In Omaha sidewalks may be constructed by the Board of such material and in such manner as is deemed proper and necessary. Owners of property must repair and are liable for injuries to persons after notice of defects. Actually, sidewalks are laid by property owners under permit from the Board to a large extent and the Board takes little care of them aside from a repair gang on wooden sidewalks, of which there are many miles.

In Cleveland the Council usually passes ordinances for laying sidewalks where needed, after which the property owners are notified to lay them. If the order is not complied with, the proprty is assessed and when the money is paid the city lays the walks. Sawed sandstone two and a half inches thick is always used.

Sweeping of paved streets is done by Indianapolis under contracts with street cleaning companies and until last year the cost was assessed on the abutting property. By a change in the charter the cost is now paid by the city on the ground that it corresponds to the repairs and cleaning of unpaved streets, which the city has always paid.

Milwaukee and Omaha clean streets at public expense.

Street sweeping in Cleveland has been done by contract for several years. The State law was modified last winter making it optional to clean by contract or by the street department.

Street Sprinkling is done in Indianapolis on petition of a majority of the property owners on the portion of the street to be sprinkled, and the cost is assessed on the property benefited. In Omaha the Council may provide for sprinkling streets and assess the cost on the abutting property per front foot, without petition. In Milwaukee street sprinkling is now done throughout the city and is paid out of a general fund, the city hiring teams and drivers by the month. A very large force is necessary.

The charter of the city of Indianapolis contains an indefinite clause regarding Civil Service, which has been interpreted by one party as optional and by the other as obligatory. Under the administration of the second party, a Civil Service Commission was appointed and examinations of applicants were held. Little noise was made and the machinery was not very elaborate, but the results were a decrease in the interference of politicians with appointments and a marked increase in the ability and reliability of employees. Milwaukee is now acting under a city service law passed in 1895, with a Board of City Service Commissioners and a Chief Examiner and Secretary. The law and the rules of the Board are full and seem to be practical. The system is reported to have greatly elevated the class and standing of employes of the different departments.

The following are given as examples of the time necessary to carry improvements through in various cities, and probably give the extremes of simplicity and complexity, and of time consumed. The time given is probably the shortest possible under the given system. Frequently there are delaying circumstances which greatly increase the time consumed.

In Indianapolis, Alabama Street from Eleventh to Sixteenth was paved this year. The improvement resolution was adopted *April 3*, Publication was made April 4 and 11, Remonstrances were called for on April 20 and none were presented. Ten days passed during which resident property owner could file a majority remonstrance, which was not done. Advertisement for bids appeared May 4 and 11, *Bids were received May 15*. Bond of contractors was approved May 20. The pavement was 2296 feet long, with street car tracks, 10,751 square yards of asphalt. *The work was accepted and the assessment roll approved, August 24.*

In Omaha, Sherman Avenue was repaved last year. The petition for repaving was presented *August 28, 1894*. Ordinance creating Street Improvement district was passed Sept. 27, 1894. Repaving was ordered by ordinance and 30 days given to select material, passed same date.

Petition designating material was presented Oct. 30, 1894. Meantime bids were received Oct. 19 for all materials, that property owners might have information in deciding upon material. Litigation delayed the approval of the contract from about Oct. 7 to Jan. 22, 1895. The final estimate was made Oct. 25, 1895, and the ordinance making the tax levy was passed Jan. 23, 1896, after passing through the hands of the Board of equalization.

The manual of the Board of Legislation of the City of Cincinnati states the steps to be taken in the improvement of a street and gives the shortest time likely to be taken from the appearance of the grade ordinance to the acceptance of the work from the contractor as eight months, about two months being allowed for the construction. Trunk sewers are carried through by actions of the Board of Administration only, without reference to the Board of Legislation, and the time from advertisement of preparation of plan to awarding of contract is slightly more than one year in the example given. For sewers other than trunk the following is the example given: (1) *Notice of preparation of plan advertised by Board of Administration commencing April 7.* (2) Plan adopted April 27. (3) Resolution declaring necessity to improve recommended to Board of Legislation June 12. and (4) read first time, (5) Read second time June 19. (6) Passed June 26. (7) Advertised July 11 and 18. (8) Ordinance to improve sent to Board of Legislation August 27 and (9) read first time August 28. (10) Read second time September 4. (11) Passed September 11. (12) Approved by Mayor September 14. (13) Ordinance advertised September 17 and 18. (14) Advertisement for bids commencing October 19. (15) Bids opened November 18. (16) Resolution to contract sent to Board of Legislation November 21. (17) Read first time November 27. (18) Read second time December 4. (19) Adopted December 11. *(20) Approved by Mayor December 12.* (21) Assessing ordinance passed Board of Administration February 26.

The time taken in Indianapolis from adoption of improvement resolution to letting of contract is seen to be about six weeks, and this time will be shortened ten days for sewers as it is not necessary to wait ten days for remonstrances. The time taken in Omaha, notwithstanding the number of ordinances, is but little over two months if there is no litigation, and this may be reduced to six weeks if necessary. In one case the time taken from presentation of petition for change of grade to letting of contract for paving was six and one-half months, the grading, curbing and paving being done under separate contracts. The time required in Cincinnati is from six to eight months.

The Committee would suggest the following recommendations as a result of their consideration of the foregoing and other information of the same nature.

I. Terms of four to six years for Mayors, possibly without eligibility for reëlection.

II. As to composition of Board of Public Works.

1. Annual appointments of members of the Board, not more than one-third of the membership to be changed each year, the first appointment by each Mayor to be made six months after his accession to office, and others annually thereafter.

2. When the city is large enough the members to be engineers or experts in their respective departments, and to be placed in charge of definite departments of the work, sewers, water, streets, etc., etc., according to local needs, and that each department have its force of engineers under the department head, the heads to work as a Board of Public Works, in a manner similar to that in use at St. Louis.

3. Where the city work is not extensive enough to need so large a plan, the City Engineer to be the President of the Board of Public Works, according to the Milwaukee plan.

4. Territorial qualification is frequently a drawback. As the tendency of appointments to Boards is always towards a territorial distribution, the advantages of that system will generally be secured without preventing the appointment of good men in case they can be better secured on other considerations.

5. In cities too small for a Board of Public Works, a Committee of the Council or a Board serving with small pay can be appointed, the City Engineer to be chairman and executive officer and the Board to act largely in a judicial capacity.

6. The great principle to be followed is that of continuity of policy and management regarding public works. The principle is quite the opposite of the great American principle of rotation in office, of change simply for the sake of change, but as the period of public extravagance passes, living gets closer and the beauties of economy begin to show themselves, the loose methods of making public expenditures now in vogue will go out of fashion and the better methods will begin to come in. A great assistance in securing the continuity spoken of will be some form of civil service examination whereby the best men can be secured and retained during good behavior. At present we have on the one hand those who would give us a "business administration" and as they have no civil service examinations in their own business, therefore need none in their administration of city affairs. They forget that their methods of securing and advancing men in their employ are the best forms of civil service examination, and that their business goes on for years under the same management, while the city officers change at frequent intervals and are strangers to most of the men in the subordinate offices. It is to be noted that the men giving a "business administration" are those who

make the cleanest sweep of the offices when they get into power. Another point not to be forgotten is that of favoritism, whether political or personal. Few large establishments are free from this drawback to good work. Many railroad systems are over-run with it. In its political form it is the curse of city affairs. On the other hand are those who would eliminate all personal element by an inflexible system of examinations and appointments thereunder, which in its strict application is the death of all progress in the direction of non-partisan appointments, because it is so obnoxious in many of its features, and fails to secure the results desired, being too apt to give the offices to unpractical men who are better with their pens or tongues than in doing the practical work to be assigned. Modifications which admit more opportunity to select the practical man from among those with sufficient knowledge are sometimes presented, and with honest administration, such as would be encouraged by the methold of appointing heads of Departments proposed, will give better results than either extreme method. Methods of examination should also have some flexibility, that the applicant may have an opporunity to show his capabilities in his best way, rather than try to show them in the unfamiliar way fixed by the ordinary examining Board.

7. If the Board is not all engineers, it should have (the City Engineer being President) at least one good business man and an architect, builder, engineer, or technical man of similar character, and if possible one who is thoroughly familiar with all branches of the city's work. Members of the Board come into this knowledge if retained long enough. An attorney is sometimes a good selection.

III. As to carrying on public work.

1. The first question is as to the relative authority of the Board and the Council. As at present managed, the entire independence of the Board in Indianapolis works well and the city has developed in its public works more in the five or six years since the adoption of the new charter than in all its life before. The spirit of American government is against such autrocratic power as the Indianapolis Board can exert. The only check on it is the fact that the Mayor is the responsible head and the terms of office of the Board are directly dependent upon his word. The Mayor is therefore the power behind the Board to determine the direction and amount of its activity and he is directly responsible to the people and removable every two years. If we secure the vast advantage of continuity of administration, we must curtail the power of the Board to a considerable extent. The St. Louis method of doing this is excellent, in that all plans for works proposed by the Board must be approved by the Council before contracts are proceeded with, but the Council has only the power of approval or disapproval, not of modifica-

tion. The Milwaukee method is nearly as good, since the plan must be satisfactory to both Board and Council. The advantages of the method where the Board originates plans for improvements, over that where the Council controls the entire matter, are too obvious to need discussion.

2. The next question is as to the relative authority of the Board and the property owners. The independence of the Board and Council, so far as property owners are concerned, in the matter of sewerage, is a well established principle and is eminently proper. Citizens generally know little of the sewerage system and are seldom able to pass an intelligent judgment on the matter. In street paving the justice of independence of Board and property owners is not so clear. The American principle of self-government again steps in and demands individual expression of opinion. When it is carried so far as to give the property owners the power to select the material for the pavement without power of Board or Council to modify this decision, it is carried much too far for the public good. The miles of bad pavement and the millions of money wasted on account of this provision in city charters call loudly against it. Even a provision requiring a majority petition from the property owners before a street can be improved, gives them too much power for the good of the city at large. The Board should have the power to select the material to be used and the manner of laying, with approval of Council on the matter of constructing or not constructing, but not as to details of construction or materials, and should have the power of beginning proceedings towards securing the pavement without petition. The provision of a remonstrance being able to stop the work will give a check on too liberal a use of the Board's power. Whether this remonstrance shall be of a majority, one-third, two-thirds or other proportion, or whether it shall be of the property frontage or of the number of property owners or of the number of resident property owners, and whether it can be over-ruled by the Council and the vote necessary to so over-rule, are questions for local determination. Again the Milwaukee provision of an annual submission by the Board to the Council of a scheme for the year's work in improvements is excellent, but a provision that the individual Aldermen of the various wards must be satisfied, would not work well, especially with the provision in force that the city shall pay for repaving.

IV. As to franchises for water works, gas, street cars, electric lights, telephones, etc., all contracts should be in the hands of the Board of Public Works with reference to the Council for confirmation. All these franchises are valuable property and should be made to bring in a revenue to the city in proportion to the profits of the business. All plans should be under the control of the Board, and construction under its supervsion, and the city pavements and other structures should be carefully taken care of. Street railways should at least pave the width they occupy, including ties, and keep in repair. Preferably both should be done by the Board and the cost assessed to the Company.

Enough has been presented for one report and sufficient ground has been covered to give subjects for much discussion. Mr. Kennedy's paper will present some additional light upon the work of Boards of Public Improvements. There are so many local considerations which affect the methods of procedure that no general plan can be detailed which will suit all cases, but a general agreement can be reached as to the principles upon which the methods of appointment of Boards of Public Improvement and the arrangement of their work should be based. This report has attained its end if it has given an intelligible basis for a discussion by the members of the Society, of the portion of the field which we have attempted to touch upon. The entire field is too large to present for any one period of discussion.

MR. BROWN: I have the pleasure to say that Mr. Kennedy has a paper relating to this same subject. The committee did not have Mr. Kennedy's paper until after this report was completed.

MR. KENNEDY: I will say that my paper is prepared, but I will not read it as there are other matters to be discussed, and I will therefore just hand this in and if the Convention will permit, it will appear in the published proceedings.

Mr. Kennedy's paper is as follows:

MUNICIPAL GOVERNMENT.

BY JOHN L. KENNEDY, BOARD OF PUBLIC WORKS, NASHVILLE, TENN.

TO THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT, IN SESSION AT CHICAGO, OCTOBER 18, 1896.

At the time of the adoption of our Federal Constitution and our form of State and National Governments, American cities were few and small, but the habit of our people has been to concentrate and we are rapidly developing into a Nation of great cities.

Three now boast of more than a million inhabitants each. Twenty-five or more exceed 100,000 each, while smaller Municipalities ranging in population from 50,000 down to 5,000 are so numerous throughout our States that they scarcely attract the notice of a traveler as he passes them.

And the tendency to city life is increasing with accelerated velocity. In each of these cities there must be, subordinate to the Federal and

State Government, a separate and distinct local Government emanating directly from the people of the city and operating directly upon them, and in theory conducted according to the expressed will of the majority.

The purpose of this separate Government is to promote the general welfare; to restrain the vicious; to secure to the provident the fruits of their industry and frugality, and to protect all in life, liberty and the pursuit of happiness in their common affairs.

The matters which are most directly committed to the management of this local Government are direct taxation and public expenditures, police regulation, fire protection, public property, public improvements, public education, public charities and senitation, and the granting of franchises to aggregated capital.

These local Governments are administered by officials selected by the people from the people whom they serve. Experience has demonstrated the inefficiency of that form of Municipal Government which confides the entire control of the public business to a body of Aldermen and Councilmen who work by and through committees appointed by themselves, and the tendency now is to concentrate work and responsibility upon a select few, chosen for the purpose, reasonably compensated by a fixed salary and held to a strict personal accountability for fault or failure. This movement is in the right direction, but much remains to be done before approximate perfection is attained. It is not supposed that this society can revolutionize the entire system of Municipal Government, but great good can be accomplished if the members will seek to discover and correct the defects in their respective Governments. And it is possible that from necessity and varied experience there may be evolved ideas and suggestions that will enable some fortunate city to secure for itself a more perfect form of Government than any which is represented in this society.

It occurs that this laudable work would be facilitated by examining some particular Government, now in operation, allowing each member to compare it with that Government with which he is most familiar and note defects and advantages. With this view we present the principal features of the charter adopted in 1883 for the Government of the City of Nashville, Tennessee. and which with slight amendments has been the fundamental law for thirteen years.

The city is for municipal purposes divided into twenty wards. The corporate authorities are vested in a Mayor and City Council, a Board of Public Works and Affairs, and in such officers as may be appointed or elected in pursuance of law.

The City Council is composed of twenty councilmen elected for a term of four years, at a general election, by the qualified electors at large of the city, but not more than one residng in any ward shall be eligible. This general election is held every two years, when only ten Councilmen are chosen.

The Mayor is also elected at these general elections for a term of two years. Councilmen receive no compensation. The Mayor is paid a salary.

The Board of Public Works and Affairs is composed of three members elected by the City Council, one member of this Board being elected every two years for a term of six years.

The members of this Board are paid a salary, must not engage actively in any other business, but must devote their whole time to the conduct of the city's affairs. Their duties and responsibilities are great as will hereafter be shown.

The City Council elects a City Attorney, City Marshal, Health Officer, Tax Assessor, Comptroller, Treasurer and Recorder, who also presides as Judge of the Police Court. They all have their respective duties under the law and are paid a salary.

A Board of Education is elected by the City Council. The members of this Board receive no compensation. They have charge of the Public School property, select the teachers, etc.

The Ctiy Council elects it own President, and holds two regular meetings each month, but may be convened in special session at any time on the call of the Mayor, or, in his absence, by the call of the President; but at the sspecial meetings business is restricted to the object stated in the call. Laws are enacted after being passed on three several readings by a majority vote, on the third of which readings a majority of the whole number of members shall be required, and a law thus enacted must be submitted to the Mayor for his approval.

He may approve or veto the law, in whole or in part, but it may be passed over his veto by a majority of all the council.

If he neither approves nor vetoes a law within a specified time, it becomes the law without his approval.

The Mayor and City Council within certain limitations have power by ordinance to levy and collect taxes, to license and tax various lines of business, to appropriate money for the expenses of the city, to make regulations to secure the health of the inhabitants, to establish hospitals, to provide waterworks, to establish a system of free schools, to make appropriations for streets, bridges, sewers, etc., to suppress crime, impose fines for breach of ordinance; to grant rights of way through the city to certain *moied* corporations, etc.

The Board of Public Works and Affairs have exclusive power and control over the construction, supervision, cleaning, repairing, grading and improving the streets, alleys, avenues, lanes, public wharves and landings, market-houses and spaces, bridges, sewers, drains, ditches, culverts, canals, streams and water courses, sidewalks and curbing, and the lighting of all such public places, repairing, cleaning, lighting and heating of all public buildings (except public school buildings) and grounds and over all public improvements of the city.

The Board of Public Works and Affairs has exclusive power to employ such chiefs and heads of departments, policemen, firemen, engineers, superintendents, clerks and other persons necessary for the execution of its duties and fix their compensation within limits prescribed by the Mayor and City Council, but the wages of common laborers are fixed by the Board. All these employes may be removed at will by the Board.

This Board also has the exclusive power to organize and control the Police and Fire Departments, to control the water-works and its appurtenances, the work house and the city hospital.

On a fixed day in each year, the Board of Public Works and Affairs prepares and submits to the Mayor and City Council an itemized estimate of the amount of money deemed necessary and advisable to spend in the execution of the duties of the Board for the ensuing year, specifying for what department, etc.

This estimate is considered by the Mayor and City Council and after being allowed in whole or in part, the taxes are collected accordingly and carried to the credit of the Board of Public Works and Affairs.

This fund is then drawn upon by the Board for expenses incurred and improvements made during the year.

Contracts over $50.00 and less than $500.00 are let to the lowest competent responsible bidder, without referring the matter to the Council. But when any contemplated expenditure exceeds $500.00 the Board first transmits to the Mayor and City Council a careful estimate of the cost of the material or work, with an ordinance authorizing the expenditure.

If the Mayor and City Council approve of the expenditure, the ordinance is passed, the money is appropriated and the Board proceeds to make the purchase or execute the work, awarding the contract to the lowest competent responsible bidder.

If the proposed expenditure is not approved, the ordinance is rejected and the money remains in the treasury.

The Council cannot compel the Board to make any specific improvement or expenditure; and is itself forbidden to make any appropriations of money or credit in the way of donations, etc. Neither the Council nor the Board can appropriate the revenues or taxes for any purpose other than strictly municipal purposes.

The foregoing is an outline of the fundamental law of the city as established by the State Legislature; and the State Legislature only can alter or amend it.

There are many minor but salutary checks and restraints throughout the entire system of the Government.

Business sessions of the Board of Public Works and Affairs are open to the public, a record of the proceedings is kept and any citizen may consult the same.

Under this form of Government, the city has been administered since 1883, and public progress has been great, as attested by many new and handsome public buildings, extensive and substantial streets of brick, granite and macadam; a system of sewers eight or ten times as extensive as in 1883; a free iron bridge of ample dimensions and handsome design spanning the Cumberland River; a city hospital; a city water-works of a capacity more than twice the present necessities; a fire department and a police department ranking with the best in the country.

The taxable property of Nashville as returned by the Assessor in 1883 was $17,198,389.00. In 1895 it was $35,072,475.00.

The population in 1880 was 43,350; in 1890 it was 76,308, while in 1895 it was fairly estimated at 87,000.

Nashville's experience has demonstrated the value of her present form of Government. Great good has resulted from the election of the Councilmen by a vote of the entire city; the power of the ward politician being thus minimized. And the election of only a portion of the Council at one time and one member of the Board of Public Works and Affairs at one time is a great advantage, the effect being to secure experienced officials at all times and to protect the city against the shock incident to periodical and entire change of administration.

It is a wise policy, too, that confers upon the Mayor and City Council the sole authority to levy and collect the city taxes, and to restrict the expenditure of the same, but with no power to direct or compel it. The Board of Public Works and Affairs being alone empowered to make public improvements, must show good reason for any proposed expenditure before the Council will appropriate the necessary money. This prevents favoritism to localities or individuals.

The Board of Public Works and Affairs being held responsible for the proper performance of the duties committed to its charge is wisely permitted to employ and to discharge at will all subordinates. This secures skill and fidelity.

It is believed that Nashville's system of Government may well be adopted by a city of far greater proportions.

It must be conceded, however, that no form of Government has ever been devised that will secure the blessings of civilization and liberty to a people who are not ever watchful and true to themselves.

Honesty and intelligence must be constantly on the alert.

The writer ventures the opinion that the best form of city government is one that is as simple in construction as practicable and with which the people can easily familiarize themselves. And that it should be administered by a limited number of executive officials clothed with ample power to properly perform all required duties, being permitted to select their own heads of departments to whom special work is assigned, and to discharge at will any head of department or subordinate.

The Legislative department and the Executive department should be distinct and the line between their respective duties and authority well defined and insurmountable. The Legislative department should provide the revenue, but should not direct the expenditure.

The Executive department should have no authority to raise any revenues but should have the exclusive power to expend the same under such restrictions as the Legislative department might impose to secure fidelity and to prevent a subordination of the public good to the interest of a select few.

The salaries paid to these various officials should be sufficient to attract men of the first order of business and sagacity, and their terms of office should be of long duration, expiring periodically, but so adjusted that less than a majority will go out of office at any fixed time. But paramount to all else it is necessary to place honest and intelligent men in office. Honesty and intelligence can safely administer any form of government until it can be changed, but ignorance and dishonesty can injure and distress a people under the best possible form of government.

To place good men in Municipal office is sometimes difficult, but this would be largely overcome if at the popular election no other matter was voted upon.

The election of no County, State or Federal officer, nor the decision of any economic question should be submitted to the people at the time when they elect their Municipal officers.

There would then be less swapping of votes and pooling of issues and little opportunity for monied combines or evil doers to influence elections by the use of money, or by other wrongful methods.

PRESIDENT HERRMANN: The next report is that of the Committee on Garbage and Street Cleaning. Is Mr. Johnson in the room? If not, the next on the program is the Method of Treating Garbage in Milwaukee. Dr. Kempster is not present and this paper is nine pages long. Shall it be read by the Secretary, or simply be read by its title?

Dr. Hess: I make the motion that the paper be read. There are a number of gentlemen present who have an interest in the paper.

The Secretary then read Dr. Kempster's paper.

THE COLLECTION AND DISPOSAL OF GARBAGE IN MILWAUKEE.

BY WALTER KEMPSTER, M. D., COMMISSIONER OF HEALTH, MILWAUKEE, WIS.

A recent writer says that the proper way to dispose of garbage is to eat it, then tells the reader how much greater waste there is in this country than in many others, and that people should be taught to stop the waste, and thus solve the problem. While the people are being taught this lesson the waste will go on, and some plan must be devised to effectually dispose of it. How to do this has already passed from the theoretical into the practical stage.

Looking at the subject in a broad way, two plans present themselves for the solution of this question. The one is cremation or incineration. which entirely destroys the whole mass, leaving a little ash as residuum. The other method is to treat the garbage in such a way, that while it destroys all offensive matters, the product which remains has commercial value. And each plan has its advocates.

In common with other cities, Milwaukee has passed through some experimental stages with this subject, ranging all the way from dumping the garbage into the lake, to the employment of the Merz system, which has now been in use more than four years, and while there are some defects in the method which will doubtless be remedied in time, on the whole, the system now in use in our city has given satisfaction, and when properly managed, will solve the vexed question of how to dispose of garbage in a satisfactory manner without excessive cost.

One of the great difficulties to contend with, and one which must be overcome, is to get rid of the large quantity of water the garbage contains. It is estimated that 75 per cent. of the total amount collected is water, and how to dispose of this enormous quantity is the problem. It will not do to permit this material to drain off, for by so doing we fail to accomplish that which must be done.

The practical conditions must be looked clearly in the face, and while we may theorize, and pass ordinances that "slops," so-called, must not be thrown into the garbage bucket, this will continue to be done so long as the domestic tyrant continues as she is to-day. Neither should we refuse to collect garbage wherein may be found tin cans, old boots and the other offal from every dwelling, for if it is rejected by the garbage scavengers, it must subsequently be picked up by the collectors of refuse; and, therefore, is still a nuisance wherever this latter material may be dumped.

Four years ago the city of Milwaukee entered into a contract with a company having control of what is known as the Merz system for reducing garbage, and the city has been operating under this system for a sufficient length of time to enable us to speak with some degree of assurance as to its utility.

The collection is made by the same company and is as follows:

The contract with the company requires them to collect all garbage offal, dead animals and animal matter, which includes all meat and carcasses, together with the fruits and vegetables seized for any reason. The terms of the contract require all garbage to be collected at least three times a week from the 1st of May to the 1st of October, and at least twice a week from the 1st of October to the 1st of May, or as much oftener as the Commissioner of Health may think proper.

The garbage from all hotels, flats and boarding houses is collected daily.

The collecter dumps the garbage from a water-tight receptacle into a garbage cart constructed for that purpose. This cart is water-tight and provided with iron lids to prevent the escape of gases, etc., but an improvement could be made on those now in use.

Each collector takes two or three loads each day, and there are 65 of these wagons now in use besides the covered vans for removing the animals. Each wagon box holds about 1500 pounds.

The cart is driven to the dock owned by the company, where the box is lifted by derrick over the wheels, swung over the barge and dumped into the hold.

We have a city ordinance providing that the collectors of garbage may reject that which contains ashes and rubbish, but, like many other ordinances, it is more honored in the breach than in the observance, and the contractors have been fairly good natured with our people in collections, notwithstanding they have a right to refuse the collections as above indicated.

The reduction plant is situated on the shore of Lake Michigan, about fourteen miles north of the city, and to this point the garbage is taken in scows; drawn into the works upon a tram car, emptied upon the receiving floor, the tin cans, bottles and other material which would injure or interfere with the subsequent steps, is sorted out, and the matter is thus ready to pass through the subsequent stages.

The Merz process has been heretofore described, and doubtless has been seen by many of the gentlemen present in practical operation, so that any extended description of it is not necessary. Perhaps the most perfect plant of the kind now in operation is in the city of St. Louis, where some recent improvements have been added, and where it is necessary for the company operating the plant to exercise extreme vigilance to prevent the escape of noxious odors, as the plant is located within the city limits.

Briefly stated the several steps of reducing the garbage are as follows:

After the removal of the foreign substances, such as fruit cans, bottles, etc., the garbage is passed through a chute into what is called a dryer, where it is subjected to a high temperature, drying off as much of the water and gases as possible, the process of drying being aided by mechanism inside of the dryer, which keeps the mass constantly stirred. The vapor and gases which are given off during this process are drawn through condensors, and afterwards forced into the furnace, where they are burned.

When the mass in the dryer has been deprived of as much water as is necessary to conduct the further steps of the process, the dried material is then conveyed by suitable apparatus into an extractor, which, when filled is fastened so that it is gas-tight, and then naphtha is forced into the extractor until it covers the mass. The naptha disolves the grease which is drawn off with the naptha into an evaporator, where the naptha is vaporized and afterwards condensed so as to be used repeatedly. The grease, after being deprived of the naphtha, is drawn off, either into a purifier where it is more thoroughly cleansed, or is at once drawn into barrels or tanks, and is ready for the market.

The mass from which the grease has been extracted is passed through a species of bone-mill, where it is ground, afterward screened, and then put up for shipment as a fertilizer. After passing through the several stages of this process garbage looks something like coffee grounds, is dry and has no disagreeable odor. I am informed that in ordinary times both grease and reduced garbage find a ready market.

The grease from dead animals, or from meats which are seized because of disease, is treated in an ordinary rendering tank, and is kept separate from the grease obtained from garbage, which latter is of fine quality, coming from cream, lard and the roast joints of the kitchen, and when purified is of fine quality.

An important question likely to be asked by persons interested in this process is "what it costs?"

The cost to the City of Milwaukee is determined at the present time by the terms of the contract, and as this is a business affair pertaining to those who have the contract, I am unable to state the actual cost of the several steps in the process; but it is fair to assume that if the business had cost the company more than they receive from the city they would have gone into bankruptcy; it is needless to say the company is believed to be quite solvent.

The terms of the contract made with the Wisconsin Rendering Company are as follows; For the collection of the garbage, dead animals, etc., and for transporting the same from Milwaukee to their works, the company receives $43,000 per annum for a term of five years, and for destroying and converting of the garbage, etc., the company now receives $33,000 per annum, paid in monthly installments, at a total cost to the city at the present time of $75,000 per annum.

An estimate made of the quantity of garbage collected and consumed for the nine months ending Sept. 30th, 1896, is as follows:

During that time there have been 30,046 loads of garbage collected by 63 wagons, each wagon carrying an average of 1500 pounds; and each collector averages two loads per day. The total amount collected during that time calculated in tons. gives 22,534, an average of 79 tons per day. Upon an estimated population of 260,000 this gives 19 pounds per capita per month, or 63 one hundredth pounds per day.

Under the contract the cost to the city at this time is $2.56 per ton, but, as above stated, this does not represent the actual cost, as it is presumed there is a margin of profit to the contractors.

It will be observed that the largest item of expense under the existing contract is that of collecting and transporting the material.

The location of the reduction works near our city makes it necessary to handle the garbage more than if it were taken by the collector direct to the reduction works, as they do in the city of St. Louis; so that it is fair to assume that the cost of transportation is more in Milwaukee than in St. Louis. where the St. Louis Sanitation Company has a contract with the city which provides for the payment by the city of $1.80 per ton of garbage treated, up to an average of one hundred tons per day, and all over this amount the company has agreed to reduce free of charge.

There has been no complaint made, that I am aware of, by any of our citizens because of the cost of the city of having this work done. The principal cause of complaint among our citizens is that the garbage is not always collected in accordance with the terms of the contract, some houses being omitted from time to time in the districts which are allotted by the rendering company to each collector.

As a measure of precaution to the citizens I would suggest that if it is thought best to allow the garbage to be collected and disposed of by a company, the contract should be so worded that for each default on the part of the company, which is verified, a specific sum should be subtracted from the monthly payment, and that the matter of collection should be under the supervision of the Health Department, with specific penalties named in the contract for non-fulfilment of any requirements.

This system, when properly carried out, leaves little to be desired, and if sanitary collecting wagons are used, and the works are properly built and conducted, and provided with such modern appliances as practical experience has demonstrated to be of value, it would seem to satisfactorily settle the question which has disturbed municipal authorities, and especially boards of health, not a little.

The firm which has undertaken to manufacture the necessary apparatus for the reduction of garbage, has recently completed additional apparatus for the treatment of night soil, the apparatus to be so placed as to utilize steam, water, ec., from the garbage reduction works; and this firm advises me that they can furnish and set up in complete working order, exclusive of grounds or buildings, the necessary apparatus to reduce fifty tons of night soil in 24 hours, for the sum of $36,000, and that this apparatus is as complete in its way as the garbage reduction works, and this would be about the cost for apparatus to treat garbage with. The product resulting from the treatment of night soil makes an excellent fertilizer, and finds ready sale in the markets for such purposes.

With this combined apparatus it would seem that the subject which has for so long a time disturbed the peace of mind of all who have had to deal with the matter, would solve the problem in a manner satisfactory to all concerned. So far as the treatment of garbage is concerned we are entirely satisfied with the Merz method, and speaking for myself, I believe it would be best for the city to own and control the whole machinery, including its collection and its final disposal.

President Herrmann: This finishes the list of papers that we have on the program and we are now ready for general business.

Mr. Cappelen: If you will excuse me, I would like to make inquiry from those gentlemen who have had something to do with the coating of steel pipe as to what is the best coating for a steel water main pipe. It is a very important subject. I have about seven miles of a forty-eight-inch main to lay and I do not know if I am going to adopt cast iron or steel. I think I can save several thousand dollars by adopting steel, but I am at sea as to what is the best coating for a steel pipe.

Mr. Sherrerd: This same question worried the city of Newark considerably. When the first riveted steel pipe with asphalt coating was laid, there was a question among the citizens as to its durability. When the second line was laid, as I said in my paper, it was necessary to uncover the first line in a number of places. We have examined it very carefully and failed to find any indication of deterioration with the exception of a few places around rivet heads where there had been slight leaks. I have gone into the question pretty thoroughly and made examinations on the ground and consulted with different chemists with regard to the composition of the secondary coating or skin under the asphalt to which I refer in my paper. This method is quite certain to prevent deterioration from the very fact that it combines two coatings. I understand that there is one treatment for coating steel that was patented—I do not know that it is still covered by a patent—which involved heating the pipe to a certain temperature at which the sesquioxid or Fe-2 o-3 is changed to Fe 3 o 4; the latter compound remains stable and does not continue to oxidize or rust. In answer to Mr. Cappelen's questions I would say, there seems to be still some difference of opinion as to whether the Sabin process or the asphalt process is the best. I understand they are about the same in cost. The method of applying the asphalt coating, I must say, gives very good results in Newark, and the fact that the heating of the pipes before dipping is carried up to 300° Fahrenheit also seems to insure the under coating.

Mr. Cappelen: There is one point, if you get a certain surface water that contains sulphurated hydrogen, it will eat up asphalt coating, and I would like to know if any gentlemen here have had any experience with that particular kind of coating. I have taken up water pipes 22 years old coated in coal tar and found them in perfect condition.

I think this is a subject of such vast importance that it might be even well for the president to appoint a committee to take charge of nothing else but coating of cast iron and steel riveted pipes, and report on this question. I have seen the reports made by Mr. Sabin, of the Edward Smith & Co., New York, published in the American Society Records a couple of months ago, where they made the experiment in the Brooklyn Navy Yards with iron and steel plates covered with various substances and put in the harbor at Brooklyn, salt water, and of course that gentleman showed some very excellent results with those plates, which he had observed for six months, more or less. But I have also used the Smith Company's asphalt bridge paint, and the fumes of our locomotives would destroy it. The question is, was the paint destroyed chemically or mechanically? The blasts from the locomotive engines, throwing their cinders and ashes against the bridge iron, would apparently cut through the paint, which is very expensive. I hope that the President will appoint a committee on this subject; at least I would like to see the Convention take action on that, because it is very important and may be of great benefit to various members of this Association.

President Herrmann: A special committee?

Mr. Cappelen: Well, make that a special committee on asphaltic coating of iron and steel.

Mr. Sherrerd: May I say one word in regard to paints? The Pennsylvania R. R. Co. made a very thorough investigation in regard to paints on their train shed at Jersey City in order to find out regarding this very thing, and have not as yet found a paint which is entirely satisfactory. I believe that it must be a chemical action which takes place because the roofs of some of those buildings which were affected were some eighty feet above the locomotives and this action took place even at that height.

Mr. Pearson: I have been a railroad civil engineer a long time, and have had some experience as to what injures the iron of engine houses, etc., by locomotive smoke. If you will investigate thoroughly, you will find it is caused by nothing but the sulphur in the coal. You cannot burn anything, generally speaking, but bituminous coal, and there is very little bituminous coal but what is full of sulphur. In one instance, on the Monon road, we had one old shingle covered building which was used for an engine house, and all the shingle nails were absolutely eaten away by nothing but the sulphur in the coal. The old engine house trusses at Michigan City were eaten out in the same way; while with the Louisville Short Line, I put an iron roof on the Frankfort engine house and inside of six months had to replace it with an asphalt and gravel roof. Any covering that sulphur will not penetrate will protect the iron or steel and I have found asphalt preparations the best.

Dr. Hess, Cleveland: The paper on garbage disposal has been read, and apparently is not open for discussion. I represent the City of Cleveland and came here especially to hear the discussions on the garbage question and to get what information it was possible from the delegates. I would like to ask a question, if there are any delegates present who live in cities where they have a garbage disposal plant. I would like to know how satisfactorily they are operated and what is the expense of operaation as well as the cost of collection and disposal. The City of Cleveland is about to expend $100,000 on a garbage disposal plant and we are ignorant on the question of garbage disposal. Any information that we can get here would certainly be very valuable to us.

The President: Are there any delegates present who can give the desired information? The author of this paper, Dr. Kempster, is not here.

Dr. Woodward, Washington, D. C.: We have adopted in Washington the process of cremation, after a thorough investigation of the subject of garbage disposal. We are now paying $57,000 per annum for the work of collecting and disposing of all garbage and dead animals. The collection is daily from April 15 to November 1, in the entire city; tri-weekly during that period in the suburbs from November 1 to April 15; we have a bi-weekly collection over the entire city and suburbs. The collection from hotels, market houses and similar places is daily, including Sunday, during the entire year. We have one crematory, located in the city, of the Brown pattern, and it is now working satisfactorily. We are about to erect a second crematory, also in the city, to accommodate a different neighborhood; this will be of the Smith type.

The City of Washington is, of course, somewhat differently located from Milwaukee, or, I might say, almost any of the cities that have to deal with the garbage problem. The District of Columbia, which is the only territory at our command, is in itself but a few square miles in extent and all fairly well populated. It has been deemed inadvisable, therefore, to locate a garbage reduction plant within the city, or, in fact, anywhere in the District. It would have been practically necessary, if that system had been adopted, to have located the plant in a neighboring state; and for fear of trouble in cases of possible epidemics or other causes, we decided to cremate within the city. It is my judgment, after careful investigation, that a reduction plant cannot be satisfactorily located within city limits.

The President: In Cincinnati we have a contract for the destruction of our garbage running for ten years. The city collects its own garbage daily and hauls it to a garbage boat situated at the river. We have full control as to where the destruction plant is situated, being about five miles from our corporation line. It is towed there every night and destroyed by the Simonan process. They charge us on a sliding scale, running from $19,000 to $27,000 per year, the charge being increased for each year. That is for the destruction of it, the cremating only. We do our own collecting and hauling. I would estimate that the cost of that is probably about twenty per cent. of our entire cost of street cleaning and sewer cleaning. Our total allowance of that per annum is $200,000, costing us probably $40,000 per annum to collect and deliver our garbage for this company, or a total cost of $60,000.

Dr. Hess: I would like to ask Dr. Woodward if he would deem it imperative or advisable during the heated season to collect garbage daily or whether he considers tri-weekly sufficient?

Dr. Woodward: We have had experience with both. Our previous contract was for tri-weekly collections during the summer season, but we found that it was not sufficient, and it became necessary to make a special provision for a daily collection in the more densely populated section of the city. For the next five years we have provided for a daily collection during the entire heated season. We have a system of fines by which the contractor is held up to his work. Our contract provides that for each complaint of any violation of the contract, which in the judgment of the Health Officer is well founded, the contractor may be fined a sum not less than one dollar, nor more than five dollars; and if after being notified by the Health Officer to remove any dead animal or garbage, he fails to remove such dead animal within ten hours, or garbage within twelve hours, the Health Department may cause it to be removed and charge the cost of removal to the contractor up to any amount not exceeding ten dollars; so that default on his part may result in the forfeiture of fifteen dollars in a single instance. We have had very litle trouble recently with defaults.

Mr. Frost, Plainfield, N. J.: One of the principal reasons for my coming here was to learn something on the subject of garbage disposal. A company has just been formed in Plainfield to promote the Smith-Vivarrtas Crematory, which is in operation at Scranton, Pa., and the company ask for a franchise for 20 years, which I consider quite out of the question. I hoped that I would have the privilege of listening to considerable discussion on the subject of garbage disposal as it is carried on in some of our American cities, and also to a general expression of opinion as to the comparative merits of granting franchises to companies, or of direct municipal action. I may mention that Mr. Rudolph Hering is employed by the American Public Health Association to prepare a very complete report on garbage disposal. He has been engaged on it for over a year and expects to complete it early in the coming year, and I suppose when that report is published it will be the most valuable contribution on the subject that will be in print.

Mr. Drake, Buffalo: With our 360,000 inhabitants we use the Merz process of rendering our garbage. We pay on a contract of three years $35,000 per year. But the delivery is based upon the amount they haul. They are collecting about 100 tons a day; that, however, decreases as the fruit season expires. I think that the total cost is something in the neighborhood of $125,000 a year, the collection and the rendering. The location of the Merz works is just outside of the city limits, but it necessitates a long haul from portions of the city. The garbage is collected during the warm months daily, in the business part of the city, that is, where the hotels abound, twice a week in the outskirts and once a week during the winter months. I think it fairly satisfactory except the cost, believing that is a little excessive, and somehow the contractors manage to swell the amount larger than we think it ought to be, but we are in their hands and at the present time that seems to be the most desirable way of getting rid of the garbage in our city. I make this statement for the benefit of those who can make use of it.

Mr. Matty, Syracuse: If I did not speak upon this question I would fail to do my duty as a member of this Society. This question has been agitated in the City of Syracuse for about three years. Sometime in the month of May or June last a crematory was erected in the City of Syracuse to dispose of the garbage at a contract price of $17,000 for the first year, running up to six years, the last year to amount to about $23,000. The amount of garbage to be cremated was in the neighborhood of 38 or 40 tons per day. The crematory was erected, and operated less than 48 hours. We took our garbage on the outskirts of our city, having first started to deliver it in the towns adjoining; they raising the issue and carrying it into the courts, we were compelled to stop. Therefore, we have to take care of our garbage within our city limits and we bury it to-day. That is our position to-day. That is where we stand.

Dr. Hess: What is the population?

Mr. Matty: One hundred and twenty thousand, very nearly 130,000.

Dr. Hess: What system?

Mr. Matty: The crematory; the "LeGrande." One similar to that has been erected in Philadelphia, that has proved a failure also. Within the past two weeks a general committee of the Board of Health, consisting of three members of our board (that is the Board of Aldermen), and three members of the Board of Health, have visited different cities, among them Buffalo, N. Y.; Bridgeport, Conn., and Philadelphia, Pa. Buffalo being the first one visited by the members of the Board of Health, they thought it a good thing. After visiting Bridgeport, Conn., they thought that Buffalo was not in it at all; in fact, had no way of disposing of garbage as it should be. Leaving Bridgeport and going to Philadelphia and visiting their works there, they came to the conclusion that the Bridgeport plant was not just what it ought to be. Now, I believe that Philadelphia has a plant that up to the present time is the one that is most perfect throughout this land. They dispose of over 100 tons of garbage a day. They do it nicely and the floor is as clean as this room. Everything is nice and in perfect order with the exception of when they empty their iron barrels into the tanks. Now, as I say, they dispose of over 100 tons of garbage a day. It is inside the city limits (the Bridgeport plant is within the city limits); there is no odor and no smell, it is perfectly sanitary. This process has a reduction plant passing through different tanks and is connected with steam pipes running through these tanks. Then the steam and water is all condensed over again and when it comes out they draw the water that comes out, all there is left of it, into a glass and ask you to drink it. They drink it themselves and I tasted it. It looked pure and there was no taste to it. We were there at a time when they put in a horse. They cut it in four quarters and put in a quarter at a time (they cannot put in a whole horse at once), and in three hours and a half your fertilizer is there, all ground, ready to put on the land. There was nothing we could see except now and then a tin can, a piece of rag or an old boot, now and then a little stone, but not to amount to anything.

I want to say that this is the most important question in the United States to-day, this question of garbage. Any one who treats it lightly who belongs to any municipality makes a mistake. I want to tell you that it is a question you must look into, and any one who is going into the business like you in Cleveland, be careful; take plenty of time, spend plenty of money in investigating, and the money you spend in investigating the different plants you will be glad to have spent. Do not make a mistake and get a plant that is not worth a dollar, as we have. I am in favor, as a member of the Board, of a reduction plant such as I see in Philadelphia or in Bridgeport, but I believe the one in Philadelphia is better for this reason, people claim that they are operating it at a profit; at Bridgeport they say there is no money in it, yet they continue to do it.

Col. Waring went carefully into this subject before letting out a contract for New York. I have no doubt that some of the city officials present have seen his report on the final disposition of garbage in New York; it is a public document of that city and can be had on application. Mr. Hering has said, in regard to the difference between German and English garbage disposal works, that while the English are uniformly successful German works are not so. In English practice it is found that a great deal depends on the firing of furnaces and the manipulation. The quality of the men in this country is very inferior to that of men employed there. Very unskilled men are employed here and everything is done in a slipshod way as compared with methods in Germany and England. The English build their crematories in cells to suit the exigencies of the time, and they add to them as the quantity of garbage increases; they have been uniformly successful, while, in this country, garbage disposal works have been largely unsuccessful. But as time goes along I believe we will have successful crematories.

Dr. Hess: I should like to ask the gentlemen from Buffalo if they have in the Merz system adopted the steam method of disposing of garbage, or whether they still use the naphtha process, also whether in collecting they find any difference in the odor arising from garbage which they collect daily or collected tri-weekly? It is said that, where the garbage is allowed to stand for two or three days, a great deal of odor arises from it, so that if you can give us any information on that point, we will be glad to have it.

MR. DRAKE: So far as the odor is concerned, of course there is a sensible difference where the period is long in collecting, although there have been no particular complaints.

DR. HESS: Would you advise daily collections?

MR. DRAKE: I would certainly, although it makes it more expensive

MR. CAPPELEN: I told the Society about our work in Minneapolis last year in regard to this question and we have not improved on it since. The garbage is collected and hauled out of the city by railroad cars and used for general fertilizing purposes on the low land which certain gentlemen have taken charge of to improve and utilize as farming land and the city pays about $20,000 a year to have the garbage hauled out. The individual property owners pay from 5 to 7 cents a barrel for their garbage collected in houses to have it shipped out of town, and I think it is too much of a monoply. Some years ago we built an Engle crematory at Des Moines, Iowa, and it worked very nicely. We did not have to quarter a horse—we stuck the whole horse in—the phosphate went into the river and we did not get any benefit of it. But some very fine nosed gentlemen across the river had a great "pull" with the City Council of Minneapolis; said that the smell was so bad for them that the Council ordered the crematory torn down, which, in my opinion, as City Engineer, was an outrage; there was no odor hardly at all. Once in a while we might get a whiff from the chimney, but the crematory was located on a little island in the center of the river below the falls; there was a rendering factory within three hundred feet of it in which all the dogs from Minneapolis were prepared for future use and the smell of that dog preparatory was what killed the crematory of Minneapolis. It was ordered torn down and we are to-day shipping our garbage out of the city for farming purposes, and it is too much of an expense to the city—a five-year contract that increases $3,000 or $4,000 a year, as the years go on, and five to seven cents a barrel for garbage refuse collected, that is to say, you have got to collect it and haul it to the railroad and pay them to haul it out of the city, and it is costing us too much money.

Now, Mr. Chairman, I hope you will excuse me, but as the time is very short, and as I think this Society, in my opinion, is the most prominent municipal Society in America to-day, and as you have all the men you need, I would suggest that a committee be appointed on Electrolysis.

This is just simply a sample which I brought up here to show you. (Produces damaged pipe.) Our water mains are all nine feet below the street on account of the frost, so that we have no trouble with our water mains in service, but the gas companies' mains are down only five feet, and they have all the electric action you can put into them. At the same time I know of some other cities where they have the water pipes only five feet below the street. This is a gas pipe running on a street where there is a street railroad track.

I would also suggest that a committee be appointed to report to the next Convention of this Society on abolishing of railroad crossings in cities. It is a very important subject. There may be small cities and large cities. Chicago is fighting with it, Minneapolis has been fighting it. We have some of our roads down, and Buffalo is to-day fighting, in fact, it is one of these monopoly questions that comes up, how to overcome railroad crossings in cities. It is a subject that involves the expenditure of a great amount of money, and I believe that a committee ought to be appointed to give the Society the benefit of all they can learn on the subject.

THE CHAIRMAN: If there is no objection on the part of the Society, I shall appoint the three special committees that have been suggested by Mr. Cappelen.

MR. KENNEDY: As the session is drawing to a close I offer this resolution:

"RESOLVED, That a committee of three, to be known as the 'Committee on Review,' as suggested by the President in the annual address, be added to the list of Standing Committees."

Carried.

Mr. Kennedy also offered the following resolution:

"RESOLVED, That the Executive Committee be instructed to have the proceedings of this meeting printed in pamphlet form as soon as practicable, and that the Secretary distribute them to the members of the Society."

Carried.

MR. FROST: Will there only be enough for the members?

PRESIDENT HERRMANN: I may state that the Executive Committee started out last year and printed some 400 extra copies and offered them for sale at cost price. The Secretary probably will be able to tell you how many of those we have sold.

THE SECRETARY: I cannot say. Probably less than 100, not over.

MR. FROST: I did not hear of it. I was at the Cincinnati meeting last year, but I did not get a copy, neither do I remember a copy coming to our paper. I think there would be no difficulty in disposing of quite a large addition if it was properly noticed. I know from experience that it is not possible for outside parties, in societies or otherwise, to dispose of anything but the smallest edition of a publication. It is a very hard thing for a publisher to sell books without advertising them well. I am not canvassing for an advertisement, however, as I will do this advertising free.

PRESIDENT HERRMANN: I would suggest to Mr. Kennedy that it might be well to mention in his resolution how many copies are to be printed. Say 500.

MR. KENNEDY: I will accept that. Suppose we start with 500 copies and the Secretary take an option to take 500 or more as may be required.

Mr. Frost: I will take 250 copies.

President Herrmann: Let us hear an expression of the members on that subject, and may be we will be able to gauge the number we will have to have printed.

Alderman Saunders: I would suggest that an index of what would be in the book of proceedings should be sent to the different municipalities in the United States and Canada so that they can see by the same that such reports would be of value to them and in all probability induce them to join the Association.

Mr. Frost: I have found by experience in selling books that an index does not amount to much. I think that this Society ought to be most thoroughly advertised and brought to the attention of the various municipalities of this country; the widest publicity should be given its reports, the advantage of which will be seen in the future. Other societies have done this and that is one of the ways they obtain their large proportions.

Mr. Adam: I think it would be well if the members of this Society would canvass to see how many they can probably dispose of, and perhaps distribute among the members of the Board of Aldermen and others connected with the public offices and inform the Secretary of what the probable requirements of the publication will be.

President Herrmann: Then the Executive Committee may be able to gauge the amount.

Mr. Stainsby: Couldn't we have an advertisement or at least a description of the business of this convention put in pamphlet form and sent to the various cities who have not representatives here, announcing the work of this session, and that it is in print, all the papers and discussions will appear, and perhaps then they would want a copy and they would not know anything about it unless this was given them, and thereby we might bring other cities into our Society?

MR. PEARSON: I would like to ask the Secretary what the average price of the books is; what they cost last year?

THE SECRETAY: Twenty-five cents. That covered the six cents' postage.

PRESIDENT HERRMANN: I may say five cents was profit to the Society.

MR. VAN DUYNE: I move that we adopt the resolution as read and leave the matter to the Executive Committee with power to act.

Carried.

Mr. Kennedy then offered the following resolution:

"RESOLVED, That we express our thanks to Mayor Swift, and other city officials and the Committee of Arrangements for the courtesies and hospitality shown during the Third Annual Convention of this Society in this city."

Carried.

PRESIDENT HERRMANN: There are eight Standing Committees to be appointed consisting of three members each. You will, therefore, see that it is impossible to appoint every member of the Society on at least one of the committees. The constitution provides also that Chairmen of the Standing Committees may add such names as they may deem advisable to their committees. I desire to call your attention to this for the reason that sometimes members are appointed on committees who, after leaving the Convention, do not give it any further attention, and whenever that occurs the Chairman ought to take it up and add to his respective Committee such names as he may deem necessary. On the other hand, I may say that if the members of any committee ascertain that the Chairman is not doing his duty, they ought to take up the business of the Committee themselves.

The Standing Committees for the ensuing year will be as follows:

AMERICAN SOCIETY MUNICIPAL IMPROVEMENTS.
STANDING COMMITTEES, 1896-1897.

STREET PAVING:

A. D. Thompson, Peoria, Ill.
Nelson P. Lewis, Brooklyn, N. Y.
W. G. Wilkins, Allegheny. Pa.

ELECTRIC STREET LIGHTING:

J. A. Cabot, Cincinnati, O.
F. W. Cappelen, Minneapolis, Minn.
J. H. Pearson, Louisville, Ky.

SEWERAGE AND SANITATION:

George H. Frost, Plainfield, N. J.
M. A. Downing, Indianapolis, Ind.
Peter Weidner, Dayton, Ohio.

WATERWORKS AND WATER SUPPLY:

E. H. Keating, Toronto, Ontario.
M. L. Holman, St. Louis, Mo.
H. R. Sherrerd, Newark, N. J.

TAXATION AND ASSESSMENT:

G. F. Monro, Omaha, Neb.
S. C. Hathaway, New Bedford, Mass.
R. E. Horner, Parkersburg, W. Va.

CITY GOVERNMENT AND LEGISLATION:

C. C. Brown, Omaha, Neb.
C. C. Waddle, Chillicothe, O.
L. E. Farnham, Camden, N. J.

DISPOSITION OF GARBAGE AND STREET CLEANING:

Dr. J. L. Hess, Cleveland, O.
Frank V. Matty, Syracuse, N. Y.
S. Brockman, Milwaukee, Wis.

REVIEW:

Lansing W. Beach, Washington, D. C.
M. Drake, Buffalo, N. Y.
E. W. Boynton, Davenport, Iowa.

MR. DRAKE, Buffalo: I cannot forbear expressing my regrets that the question of Street Cleaning has not been taken up by this Association. I presume it is on account of the absence of the Chairman of the Standing Committee on Garbage and Street Cleaning. I think that is a very important subject, and one that Buffalo is especially interested in. We pride ourselves on having as clean streets as any city in the United States and we were in hopes that something would come up here whereby we might even improve on our present work, and, therefore, I trust, that the new Committee will not allow another year to pass without making a report and an exhaustive one upon the best methods of cleaning streets.

THE CHAIRMAN: I may state that the Chairman of the Committee, I understand, is no longer holding office. We have asked him to make a report, but he pays no attention to our request.

This finishes our business in so far as our program is concerned. Is there any other business before the Society? If not, a motion to adjourn sine die will be in order.

Adjourned.

FRIDAY, OCTOBER 16th, 1896. EVENING.

In the evening the delegates were entertained with a banquet tendered by the local Committee of Arrangements. It took place at Kinzley's.

The hall was beautifully decorated. The menu was superb.

Gen'l Fitzsimons acted as Toastmaster. The Mayor of Chicago and a number of her most prominent citizens were present.

The Toastmaster called upon representatives of the various cities, and all made responses.

The banquet closed with three cheers for Chicago.

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			1894	1895	
PEORIA ILL.			1.85	1.97	1.84 FOR 1896
MILWAUKEE WIS.	6	T. N CEMENT 50		1.91 TO 2.04.	2.84 WITH 7" CONCRETE & BRICK LINING TO TRACK & BRICK GUTTER.
OMAHA NEB.		T. N CEMENT 00	2.50 TO 3.00	2.07	THE PRICE OF 2.07 IS RE-PAVING ON OLD STREET WITH CONCRETE FOUNDATION IN PLACE AND ONLY AN ADDITIONAL SHEET OF CONCRETE 5TH. & NO GRADING.
BOSTON MASS.		T N CEMENT 50	2.25	2.25	
ST. PAUL MINN.		T. N CEMENT		2.31	
PHILADELPHIA PA.			2.50 2.46 2.40 2.40	2.35 2.30 2.05 2.25	
ROCHESTER N.Y.		MERICAN CEMENT.	2.50 TO	2.60	
DETROIT MICH.				2.48	
BINGHAMPTON N.Y.		T. N CEMENT 00		2.65	
CLEVELAND O.		24		2.85 TO 2.95	AMOUNT OF BOND NOT GIVEN.
CINCINNATI O.		00		2.75	
KANSAS CITY MO.		CEMENT		2.50 2.80	
TORONTO. ONT.		00		1.80 2.90	
NEWARK N.J.				2.70	SEE LETTER
BUFFALO N.Y.				3.00	
NEW YORK CITY				2.84 3.35	SEE LETTER 15 YEARS GUARANTEE REQUIRERED FOR ALL REPAIRING
MONTREAL CAN.		AND ENT 00		3.60	
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WASHINGTON D.C.				2.19	
TACOMA WASH.					
PORTLAND OR.					
DENVER COL.					
CHICAGO ILL.		360		2.25	
UTICA N.Y.					
COLUMBUS O.					
TOLEDO O.					
ST LOUIS MO.					
					F. W. CAPPELEN M.A.S.C.E City Engineer Minneapolis

March 19" 1896.

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THIRD ANNUAL CONVENTION.

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